# ANNUAL MANAGEMENT REPORT 1993 NORTON SOUND - PORT CLARENCE - KOTZEBUE

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#### INTRODUCTION

This report summarizes the 1993 season and historical information concerning management of the commercial and subsistence fisheries of the Norton Sound, Port Clarence and Kotzebue Sound districts. Data from special management and research projects are included in this report, but complete documentation of project results will be presented in separate reports.

Data presented in this report supersedes information found in previous management report. An attempt has been made to correct errors presented in earlier reports. Previously unreported data has been included and is indicated by appropriate footnotes. Current year catch data presented has been derived from seasonal field data.

This report is organized into the following major sections:

- (1) Salmon(2) Herring
- (3) King Crab
- (4) Miscellaneous species

In order to facilitate use of this report, tabular data has been separated into two categories: 1) tables presenting annual data; 2) appendix tables which present historic comparisons. The text for each major section is followed by tables, figures, and appendices.

SECTION 1: SALMON (Includes Norton Sound, Port Clarence and Kotzebue Districts)

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#### SECTION 1 - SALMON

#### INTRODUCTION

## Boundaries

The Norton Sound, Port Clarence and Kotzebue salmon management districts include all waters from Canal Point in southern Norton Sound to Point Hope and includes St. Lawrence Island. These management districts comprise over 65,000 square miles, with a coastline exceeding that of California, Oregon, and Washington combined.

#### Salmon Resources

Five species of Pacific salmon are indigenous to the area with chum ( $\underline{Oncorhynchus}$   $\underline{keta}$ ) and pink salmon ( $\underline{O}$ .  $\underline{gorbuscha}$ ) historically being the most abundant. Chum, pink, and chinook ( $\underline{king}$ ) salmon ( $\underline{O}$ .  $\underline{tschawytscha}$ ) have been found as far north as Barrow; however, these species are uncommon north of the Kotzebue Sound drainages. The northernmost large concentrations of chum salmon are found within the Kotzebue Sound drainages, while large numbers of pink, chinook and coho ( $\underline{O}$ .  $\underline{kisutch}$ ) salmon are not found north of Norton Sound. Very small sockeye (red) salmon ( $\underline{O}$ .  $\underline{nerka}$ ) populations exist within a few Seward Peninsula drainages.

# Commercial Fishery

In 1959 and 1960, Department biologists conducted resource inventories which indicated harvestable surpluses of salmon available in several rivers systems of the Norton Sound Arctic area. The Department liberalized various regulations and encouraged processors to explore and develop new fishing grounds. As a result, commercial salmon fishing activity has grown significantly since statehood, enabling many local residents to obtain a cash income.

The majority of commercial fishermen and many buying station workers are resident Eskimos. Commercial fishermen operate set gillnets from outboard powered skiffs to capture salmon. All commercial salmon fishing is done in coastal marine waters.

Salmon effort and catch per unit effort data (CPUE) presented throughout this section have been derived as follows. Boat (or fisherman) hours have been computed after assuming that if a fishing boat delivers during a fishing period, it fished the entire period. The total number of individual boats delivering in any period is multiplied by the number of hours open to commercial fishing. Catch per fisherman (or boat) hour is obtained by dividing the total fishermen hours into the catch for the corresponding period of time. Total fishermen (or boats) is the total number of fishermen making deliveries, regardless of how many deliveries were made or days fished during a particular period or season. There are a number of fishermen who deliver only once or twice during the entire

season. Total days fished is the total number of hours open to commercial fishing during the season divided by 24 hours.

## Subsistence Fishery

There are approximately 16,000 people in the area, the majority of whom are Eskimos, residing in more than 26 small villages scattered along the coast and the major river systems. Nearly all of the local people are dependent to varying degrees on the fish and game resources for their livelihood.

Subsistence fishermen operate gillnets or seines in the main rivers and, to a lesser extent, in the coastal marine waters capturing primarily salmon, whitefish, arctic char and inconnu (sheefish). Beach seines are used near the spawning grounds to catch schooling or spawning salmon and other species of fish. The major portion of fish taken during the summer months is air dried or smoked for later consumption by villagers or their dogs.

Subsistence catch information has been derived from interviews of fishermen, actual counts of fish, and subsistence catch calendars returned by fishermen. Subsistence salmon catches in the Nome subdistrict (subdistrict 1) have been determined from the return of catch calendars as required under a permit system.

The Department conducted annual surveys of the important subsistence salmon fisheries from the early 1960's until 1982. The majority of salmon taken are pinks and chums. Subsistence harvest information prior to 1960 is incomplete or entirely lacking for many years. Beginning in 1983 budgetary restrictions have made it impossible to conduct systematic surveys in each village as was done from 1964 to 1982. For the last 5 years that complete surveys were conducted for Norton Sound (1978-1982) the average subsistence catch was 73,000 salmon including all species (Appendix Table A8). Subsistence surveys for the Kotzebue area were less complete. An expansion of documented surveys from several years for different villages estimates total subsistence salmon harvest for the Kotzebue Sound area to approach 75,000. These reported harvests are primarily based on village household surveys. Since not all fishermen are contacted, these harvests should be considered minimum figures. More recent surveys have been conducted on individual areas and will be noted in the following sections.

## Management

The Division of Commercial Fisheries of the Alaska Department of Fish and Game is responsible for the management of commercial and subsistence fisheries in this vast area. The permanent full-time staff assigned to this area during 1993 consisted of an area management biologist stationed in Nome, one assistant area biologist stationed in Nome, assistant management biologist in Kotzebue, and two half-time Field Office Assistants (FOA's) assigned to the Nome office. In addition, summer seasonal assistance in conducting various management and research activities was provided by eleven seasonal biologists and technicians in Norton Sound and Kotzebue Sound. Additional assistance was provided by biologists from the regional staff.

The main objective of the Department's program is to manage the commercial salmon fisheries on a sustained yield basis. Various field projects are conducted to provide information on salmon abundance, migration and stock composition. Summaries of these projects are presented in Appendix G2.

Management of the salmon fishery is complicated by the difficulty in obtaining valid escapement data in this large area and by insufficient comparative catch and return information. Management problems are compounded by the need to provide not only for adequate escapements, but for the needs of several different user groups. Past Alaska Department of Fish and Game policy has been to provide for subsistence as the primary beneficial use of the fishery resource. This policy is now State law. If the subsistence harvest or demands increase, commercial fishing may be restricted. It should be pointed out that increases in commercial fishing efficiency are expected and may balance any immediate decline in subsistence utilization or increase in run size with the result that present regulations have been maintained or made even more restrictive.

The basic regulation that governs the commercial salmon harvest in all districts is the scheduled weekly fishing period. Commercial fishing regulations provide for a total of two to four days of fishing per week during the open season depending on area and season. The Department attempts to distribute fishing effort throughout the entire return to avoid harvesting only particular segments of the return. Occasionally, fishing time is increased or decreased by emergency order, depending upon fishing conditions and the strength of the returns or spawning escapements, as determined by special studies conducted by the Department. Emergency orders issued during the 1993 seasons are presented in Appendix G3.

Weekly fishery reports, which give information on fishery status and fishing schedules, are broadcast during the fishing season over radio KICY and KNOM in Nome, and KOTZ in Kotzebue. In addition, fishery news articles are published in the Nome Nugget and the Arctic Sounder.

# NORTON SOUND DISTRICT

#### District Boundaries

The Norton Sound District includes all waters from Canal Point Light north to Cape Douglas. This district is subdivided into six subdistricts: Nome (Subdistrict 1), from Penny River to Topkok Head; Golovin Bay (Subdistrict 2), from Rocky Point to Cape Darby; Moses Point (Subdistrict 3), from Elim Point to Kwik River; Norton Bay (Subdistrict 4), from Kuiuktulik River to Island Point; Shaktoolik (Subdistrict 5), from Cape Denbigh to Junction Creek; and Unalakleet (Subdistrict 6), from Junction Creek to Black Point (Figure 1).

Each of these subdistricts contain at least one major salmon spawning stream. All commercial fishing is conducted in marine waters and usually concentrated near stream mouths. Subdistrict boundaries were established around the major

salmon producing local streams to minimize interception of stocks bound for other areas.

# Historical Fishery Use

Fishing has been a part of life for Norton Sound residents for many centuries as indicated by archeological evidence dating back 2,000 years (Bockstoce, 1979). There were only a few actual pre-contact settlements like Shishmaref and Wales which still exist today. They were located where marine mammals were the primary subsistence resource. The rest of the population lived in small groups scattered along the coast and often moved on a seasonal basis prior to the introduction of western civilization (Thomas 1982). During summer months residents would disperse, usually in groups comprised of one or two families, and setup camps near the mouths of streams. Harvest levels of fish on any one stream were relatively small because of the low concentrations of people who caught only what their families and one or two dogs needed through the winter (Thomas 1982).

A large scale fur trade had been developed by the Russians in the late 1800's which continued after the American purchase (Magdanz 1981). Hundreds of commercial whalers and trading ships caused trading to increase in the region around 1848 (Ray 1975). The increased competition for walrus, caribou, and other species from outsiders may have increased the importance of salmon to area residents (Magdanz 1981). In the late 1890's gold was discovered on the Seward Peninsula and boom-towns sprang up with thousands of new immigrants flocking to the region. Commerce developed which drew people to central locations that evolved into year-round communities. Other reasons for communities to become established stemmed from the operation of missions.

The effects of mining had to be enormous on fish populations. Nearly every stream on the Seward Peninsula had some sort of mining operation working on it which ranged from simple gold panning to sluice boxes to hydraulic giants to bucket line dredges. One example of extreme impact was on the Solomon River which is only 30 miles long but had 13 dredges working at one time. Another obvious affect was simply the sheer number of people who came to live in the region between 1900 and 1930. Many places like Nome, with a population of 30 thousand and Council with 10 thousand people at one time, did not exist before gold was discovered.

It was in the late  $19^{\frac{th}{t}}$  century when the size of the dog teams increased from two or three to perhaps ten to twenty. At about the same time wooden boats began to replace kayaks (Thomas 1982). Consequently, the demand for dry fish to feed the dog teams increased along with the development of better means to harvest fish. Winter transportation throughout the region was done with hired dog teams and drivers who carried mail or freight along the coast and across the state to the ice-free port at Seward. Dry fish became a major barter item in response to the great demand for dog food which consisted of primarily chum and pink salmon (Thomas 1982).

Local residents would spend most of their summers catching and drying large amounts of salmon, some of which they kept for themselves and the rest would be bartered or sold to mining camps, roadhouses, and trading posts or stores. For

example, the Haycock mining camp on the Koyuk River would buy about two tons of dry fish each year. There were roadhouses at Golovin, Walla, Moses Point, Isaac's Point, Ungalik, Robertvale, foothills (south of Shaktoolik), Egavik, and many other locations. Dry fish was bought in units of bundles (50 dry fish tied together) at a typical price of 10 cents per pound from the fishermen. One elder in the area felt that more fish were retained for their own use as compared to the amount sold which may have averaged five to ten bundles per household (Thomas 1982).

After the gold rush the number of people gradually decreased over the next twenty years as the gold deposits were worked out. The number of dog teams diminished by the mid 1930's with the introduction of the mail plane. The last mail team contract ended in 1962 at Savoonga. Local stores continued to trade in dry fish at Shaktoolik, Saint Michael, Unalakleet, and Golovin. An example of quantity was the Shaktoolik store that had a cache 8x20x40 feet which would be filled to the top with dry fish. One elder said the stores would buy the fish for 6 cents a pound and sell them for 10 cents a pound or their equivalent in groceries and supplies (Thomas 1982). By the early 1960's, commercial salmon fishing developed into a source of summer cash and snowmachines were replacing the need for dog teams (Thomas 1982). Dry fish was no longer needed to feed dogs and cash was becoming more available for trading at stores.

## Commercial Fishery Overview

Commercial salmon fishing in this district first began in the Unalakleet and Shaktoolik Subdistricts in 1961. Most of the early interest involved chinook and coho salmon which were flown in dressed condition to Anchorage for further processing. A single U.S. freezer ship also purchased and processed chum and pink salmon during 1961. In 1962, two floating cannery ships operated in the district and the commercial fishery was extended into the Norton Bay, Moses Point and Golovin Bay Subdistricts. The peak in salmon canning operations occurred during 1963.

Since then, markets have been sporadic and some subdistricts have often been unable to attract buyers for entire seasons. A joint venture between KEG (Koyuk-Elim-Golovin) Fisheries and NPL Alaska, Inc., operated from 1984 until mid-season in 1988. A permit issued by the Governor allowed two Japanese freezer ships to buy directly from domestic fishermen and was limited to salmon caught in the internal waters of Golovin and Norton Bays. Currently, the most consistent markets are at Unalakleet and Shaktoolik where fish are purchased, iced, and flown directly to Anchorage for processing and resale.

The commercial salmon fishing season opens by emergency order between June 8 and July 1, depending on run timing within each subdistrict. The season closes by regulation on August 31 in Subdistricts 1, 2, and 3, and on September 7 in Subdistricts 4, 5, and 6, but processors often terminate their operations prior to the regulatory closure dates. Two 48 hour fishing periods normally occur each week unless changed by emergency order with the exception of the Nome and Moses Point Subdistricts, where two 24 hour fishing periods are scheduled each week.

Commercial fishing gear is restricted to set gillnets, with a maximum aggregate length of 100 fathoms allowed for each fisherman. There are no mesh size or depth restrictions during the normally scheduled periods. The majority of the gillnets fished are approximately 5 3/4 inch stretched measure. In the Unalakleet and Shaktoolik Subdistricts,  $8\ 1/4$  inch stretched mesh gillnets are commonly used during the chinook salmon run in June through early July. During years when large pink salmon runs occur, the Department provides fishing periods when only  $4\ 1/2$  inch mesh nets or less may be set or drifted. These special small mesh periods are an attempt to target pink salmon without overharvesting the larger sized salmon species.

Most fishermen do not tend their nets continuously once they are set, leaving them unattended overnight. Fish quality suffers due to the length of time fish may be left in the nets and is especially poor when storms prevent fishermen from checking their gear for extended periods of time.

## Commercial Fishery Management

The Norton Sound District is managed on the basis of comparative commercial catch data, escapements and weather conditions. A single factor or combination of factors may result in issuance of emergency orders affecting seasons, fishing periods, allowable mesh size, and areas.

Aerial surveys are used to monitor escapements in the majority of the Norton Sound streams. Weather conditions, time of day, type of aircraft, water conditions, bottom conditions, date of survey, and efficiency of the surveyor and pilot must be taken into account when making inter-annual aerial survey comparisons. Counting towers are a much more consistent and accurate method of obtaining escapement information and have been utilized on many river systems in Norton Sound. Two counting towers were operated in 1993, one on the Kwiniuk River in the Moses Point Subdistrict and on the Nome River in the Nome Subdistrict. The Kwiniuk Tower has been operated since 1965 while 1993 was the first season that Nome Tower was setup.

Commercial fishing starts for king salmon in mid June, emphasis switches to chum around June 25, then gradually shifts to coho during the third week in July. Pink salmon are abundant during even years, but there is often no market. The southern Subdistricts 5 and 6 (Shaktoolik and Unalakleet) are sustained fisheries. They target king, chum, and coho salmon, with king and coho catches remaining fairly stable while chum catches have been declining since the early 1980's. Management has consisted of a series of Emergency Orders that open the season, adjust fishing time, restrict mesh size, and occasionally eliminate a fishing period.

Commercial fisheries in Subdistricts 2 and 3 (Golovin and Moses Point) target chum salmon. The commercial chum harvest has dropped dramatically since the mid 1980's. Poor returns has caused very restrictive management actions recently where the seasons have been closed by E.O. to allow for escapement and subsistence needs.

There has been little or no commercial salmon harvests in Subdistricts 1 and 4 (Nome and Koyuk). In the Nome Subdistrict this is due to very depressed stocks which in some years require closure or severe restrictions on the fishery. Conversely, the Koyuk Subdistrict has healthy stocks but can't attract markets willing to operate in a remote area.

## Subsistence Fishery Overview

Household subsistence surveys have not been conducted district wide since 1985 in Norton Sound villages due to budgetary restrictions. Recently, the Subsistence Division has been selecting one village each year in which to conduct formal indepth studies of subsistence harvest levels and trends. The information is not used for inseason management, but identifies subsistence needs which must be considered in management decisions.

Daily surveys of Unalakleet River and ocean subsistence fishermen have been conducted annually since 1985 during the chinook salmon run. Although total harvests by subsistence fishers were not documented, effort and catch information were used to judge timing and magnitude of the chinook salmon return. The commercial fishery is delayed until it becomes apparent subsistence needs are being met and chinook salmon are beginning their upstream migration as indicated by the Department of Fish and Game test net in the lower Unalakleet River. There is a growing trend to move subsistence nets from the river mouth out to the ocean in order to avoid large debris loads from spring runoff. It is presently unclear what changes this fishing technique will have on chinook salmon escapement.

Low salmon stock levels in the Nome Subdistrict combined with a large concentration of users has required issuing subsistence harvest permits for the area since 1974. These are issued by regulation to each household and designated fishing location. Each location may have its own catch limit per permit and the fisherman is allowed to change locations after notifying the local Fish and Game office.

# Regulatory Actions in Nome Subdistrict

Although pink salmon are usually the most abundant species of salmon in Subdistrict 1 streams, the commercial fishery has targeted chum salmon. The relatively large chum salmon catches in this subdistrict in conjunction with weak local stock abundance implied that the fishery intercepts non-local stocks. A 1978-79 Norton Sound stock separation study confirmed this view. Salmon tagged near Nome were re-captured in fisheries from Golovin (Subdistrict 2) to Kotzebue. In an attempt to provide for spawning requirements in addition to an important subsistence fishery that targets local stocks, a commercial harvest guideline of 5,000-15,000 chum salmon was adopted as a regulation.

Due to poor chum salmon escapement during the 1982 and 1983 seasons, the Board of Fisheries, in response to an advisory committee petition, directed the Department to manage the commercial fishery so that chum salmon escapement could be optimized. During the 1984 fall Board of Fisheries meetings, these directives

became regulation. In response to public and advisory board proposals, the following commercial fishery restrictions were adopted as regulations:

- 1) Salmon may be taken commercially only from July 1 through August 31.
- 2) Fishing periods were restricted to two 24 hour periods per week.
- 3) Waters west of Cape Nome were closed to commercial salmon fishing.

The Department was also directed to allow a harvest at the lower end of the guideline harvest range of 5,000 to 15,000 chum salmon, as stipulated in 5AAC 04.360.

In addition to these commercial fishing restrictions, a proposal to restrict the sport fishery in the Nome and Snake Rivers was adopted in 1984:

With a bag and possession limit of 15 salmon, other than king salmon, only 5 could be chum and coho, in combination.

Subsistence permit limits in the Nome and Snake Rivers were restricted to 20 chum and 20 coho salmon. The remainder of the permit limit could be filled with salmon other than chum or coho.

However, even with these restrictive regulations in place, chum escapement goals were difficult to attain. The 1987 fishing season experienced poor returns of both chum and pink salmon to Nome Subdistrict streams. Numerous management actions were made which curtailed commercial fishing activities, and later, sport, personal use, and subsistence were also restricted. Even with such drastic fishery restrictions, escapement goals for chum salmon were not attained during 1987 in the Nome, Eldorado, Flambeau, Bonanza, Snake, and Solomon Rivers. In response to this continuing trend of decreasing chum and pink salmon returns to the Nome Subdistrict, several new regulations were adopted during the 1987 Alaska Board of Fisheries meetings.

With the commercial fishery all but eliminated in recent years, proposals affecting the sport, personal use, and subsistence fisheries were considered. The following new sport fish regulations were adopted for all Nome area road system streams (Seward Peninsula drainages from Cape Prince of Wales to Cape Darby):

- 1) For salmon other than chinook, 10 per day, 10 in possession, only 3 which may be chum salmon and coho salmon, in combination.
- 2) For chinook salmon, 1 per day, 1 in possession.

These new regulations superseded those adopted during 1984. Additional new regulations affecting personal use and subsistence fishermen which were adopted in 1987 included:

- 1) In the Nome River, no person may operate more than 50 feet of gillnet in the aggregate.
- 2) The Nome River was added to the regulation 5AAC 01.170 (e) which states that small mesh gillnets (less than 4 1/2 inch mesh) and beach seines may not be used in specific Nome Subdistrict streams.

Regulation changes in 1992 restricted the use of beach seines in the Nome subdistrict. The managers now have the authority to allow the subsistence harvest of chum or pink salmon by beach seine if escapement needs are likely to be met. Beginning in 1991, no chum salmon harvests have been allowed until escapement goals were likely to be met or conservative management actions were judged to be no longer effective. In the past beach seines were viewed as an overly effective means to harvest fish, but in 1993, beach seines were used as a means to harvest abundant species, while allowing the live release of other species experiencing depressed runs.

#### 1993 NORTON SOUND SALMON FISHERY

#### Commercial Fishery Overview

The Norton Sound commercial salmon fishing season typically begins on a date established by emergency order between June 8 and June 20 in Subdistricts 2, 3, 4, 5, and 6 and on July 1 in Subdistrict 1 as directed in regulation. Because of chum salmon conservation concerns, the Nome (1) Subdistrict did not open until August 2, the Golovin (2) Subdistrict did not open until July 13, and the Moses Point (3) Subdistrict did not open until August 6. The Norton Bay (4) Subdistrict opened on June 17, while the Shaktoolik (5) and Unalakleet (6) Subdistricts opened on June 14. The season usually ends by regulation on August 31 in Subdistricts 1, 2, and 3, and September 7 in Subdistricts 4, 5, and 6. However, the 1993 fishing season was extended through September 8 in Subdistrict 5 and 6 (Figure 1).

The 1993 Norton Sound commercial salmon harvest totaled 263,670 fish, which was comprised of 8,972 chinook, 279 sockeye, 43,283 coho, 157,574 pink, and 53,562 chum salmon (Table 1). The chinook harvest was 53% above the previous 5-year average (1988-1992) and 11% above the previous 10-year average (1983-1992). The coho harvest was 43% below the previous 5-year average and 10% above the previous 10-year average. The pink salmon harvest which is seldom a directed fishery was 864% above the previous 5-year average and 385% above the previous 10-year average. The chum salmon harvest was 31% and 57% below the previous 5 and 10-year averages, respectively. Historical catch data for the Norton Sound District is presented in Appendix Table A8.

A total of 200 CFEC permits were renewed, of which 153 actually fished during the 1993 season (Appendix Table Al). The number of participating fishermen this season was slightly above the 10 year average of 142. Typically, effort levels drop in light of poor chum salmon returns and low prices paid for salmon species.

The effort level was higher than in recent years possibly due to the increased market interest in Norton Sound pink salmon. The northern subdistricts had historically landed approximately 50% of the total commercial chum salmon harvest as compared to below average contribution of 2% this year with the southern subdistricts' portion also below their averages (Table 2).

Three domestic seafood buying companies purchased the majority of the commercially caught salmon in Norton Sound during 1993. One buyer operated out of Unalakleet, purchasing fish locally and also buying fish at Shaktoolik which were ferried to Unalakleet by small aircraft. The fish were iced in the round and shipped to Anchorage for processing via large cargo planes. The other major buyer had a processing vessel and two large tenders that purchased salmon catches throughout Norton Sound which were processed aboard ship. A third domestic buyer operated in the Moses Point Subdistrict for four periods during the coho salmon run. In addition, a few individual fishermen sold their catches of fresh salmon locally and to wholesale distributors, as permitted under the catcher-seller status.

Commercial fishermen received approximately \$322,117 for their catch in 1993 (Appendix Table All). These earnings rank as the lowest value on record since 1976, and were 35% below the previous 5 year average of \$492,425. This low fishery value is attributed to the low salmon returns, the lack of competitive markets, and low prices paid per pound for all salmon species. Prices paid to the fishermen averaged \$0.72 per pound for chinook, \$0.40 per pound for sockeye, \$0.22 per pound for coho, \$0.24 per pound for chum, \$0.15 per pound for pink, and \$1.76 per pound for coho salmon roe. These data are summarized in Appendix Table Alo.

# Subsistence Fishery Overview

Household subsistence surveys were not conducted by the Commercial Fisheries Division during the 1993 season in Norton Sound villages due to budgetary However, daily interviews of Unalakleet River and ocean restrictions. subsistence fishermen were conducted at Unalakleet during the early portion of the fishing season in order to monitor the chinook salmon return. Total harvest by subsistence fishermen was not documented, however effort and catch information was used, in combination with the Departments' test net in the lower Unalakleet River and commercial catch information, to judge the timing and magnitude of the chinook salmon return. This information was the basis for scheduling early commercial salmon fishing periods in the Unalakleet and Shaktoolik Subdistricts. Commercial fishing is typically only allowed after chinook salmon have been observed entering the Unalakleet River in building numbers for one week to assure the harvest is directed on a healthy run and not on milling fish. There is a growing trend to move subsistence nets from the river mouth out to the ocean in order to avoid large debris loads from spring runoff. It is unclear what affects this change in fishing technique will have on chinook salmon escapement.

Subsistence fishing permits are required by regulation for each household that fishes in the Nome Subdistrict. These permits identify the body of water to be fished, the type of gear used, and the bag limit which is specific to that body of water. In addition, there is a catch calendar where the permit holder records the catches in numbers of each species of fish for each day fished. If the

subsistence fishers have filled their bag limits or would like to fish another location, they can be issued another permit generally for another area after the previous one has been returned. These permits are important to management because they identify users and bag limits, but the actual catch information can not be compiled until well after the season when the permits are returned to Fish and Game.

Subsistence Division went into Elim and conducted a fairly comprehensive subsistence survey of the village salmon usage and needs. In the report (Georgette and Magdanz, 1994) total harvest of salmon by species was estimated for 1991, 1992, and 1993 in Elim. The total harvest in 1993 was 368 Chinook, 1,217 Coho, 1,726 Pink, and 1,635 Chum salmon for a total harvest of 4,946 salmon.

# Season Summary by Subdistrict

#### Nome - Subdistrict 1

The commercial salmon season was opened by Emergency Order (E.O.) on August 2. This management action to delay the season was taken in order to avoid the harvest of chum salmon which were expected to return in low numbers to the Nome Subdistrict. For the same reason, management action was taken to close subsistence and sport fishing in the area prior to the beginning of the chum salmon return. Subsistence fishing returned to its standard fishing schedule by E.O. on August 2, and beach seines were made a legal subsistence gear type with the condition that no chum salmon could be retained from the catch. Commercial and subsistence fishing was only allowed when there became little chance for removing large portions of the chum return from each system and at the same time allowing the harvest of other species. The coho salmon return appeared to be average in the Nome Subdistrict which warranted the standard fishing schedule for the remainder of the season. The total commercial harvest for the Nome Subdistrict was 611 coho, and 132 chum salmon (Tables 1 and 4). One hundred forty-one subsistence permits were issued for the Nome area, 115 permits were returned, and 74 permits documented use. Total subsistence salmon harvest for all waters included: 52 chinook, 80 sockeye, 2,070 coho, 873 pink, and 1,766 chum for a total salmon harvest of 4,841 fish (Table 2).

#### Golovin - Subdistrict 2

The 1993 Norton Sound Salmon Management Plan informed fishermen that the Golovin Subdistrict commercial harvest would be limited to 10,000 chum salmon in an attempt to protect the chum stock which has been experiencing decreasing returns over the past 5 years. This season the only buyer interested in operating in the subdistrict wanted a pink salmon directed fishery but was aware that once 10,000 chum salmon were harvested the fishery would be shut down. Therefore, the first commercial period was held off until July 1 when the fishery opened by E.O. for a 24 hour period in a restricted area with pink gear only. The intention was to not only limit the amount chum salmon harvested, but to also test the quantity and quality of the pink salmon and test the feasibility of tendering the fish across Norton Sound to the processor located near Shaktoolik. The buyer was

somewhat satisfied with the results and the chum harvest was low, making up 25% of the total catch for that period.

Two additional pink salmon periods were scheduled, one for 36 hours and the other for 24 hours. Both with the same gear and area restrictions. The last period was on July 22 after which the buyer's processing vessel departed Norton Sound. The total season commercial harvest for the Golovin Subdistrict was 1 chinook, 4 sockeye, 2,803 chum, and 8,480 pink salmon (Tables 1 and 5). The season remained closed due to lack of market.

### Moses Point - Subdistrict 3

The Moses Point Subdistrict has also experienced a decrease in number of the chum salmon returning in recent years despite conservative management actions. A preseason fisherman's meeting and a mail out of the 1993 Norton Sound Salmon Management Plan were used to notify the public that a poor chum salmon return was expected. There was little hope for a chum directed commercial fishery, and there was the possibility of a subsistence closure during the run if the chum escapement passage levels fell short of the Kwiniuk River counting tower goal. The chum salmon return was closely monitored throughout the run by both the counting tower and aerial surveys which indicated a poor chum salmon return.

On July 17 an E.O. was issued to restrict subsistence fishing in the Moses Point Subdistrict by not allowing subsistence fishing above the counting tower site on the Kwiniuk River and the entire Tubutulik River through July 31. This action was taken to protect those chum salmon that had already made their way to the spawning areas and at the same time allow for the harvest of pink and coho salmon which have slightly later migrational timings.

The coho salmon return was expected to be of at least average run strength. A buyer expressed interest in operating in the area during the coho season. On August 6 the subdistrict was opened by E.O. for a 24 hour period to test the run strength and the feasibility of shipping salmon from this remote subdistrict. Conditions appeared acceptable and 3 more periods were allowed to accommodate the buyer's schedule with the last period ending on August 27. Thirteen commercial fishermen harvested 4,065 coho and 167 chum salmon (Tables 1 and 6). The fish were gilled and gutted then sold to the buyer who accepted both the carcass and the roe. The fish were iced and flown to Fairbanks for further processing.

## Norton Bay - Subdistrict 4

The Norton Bay Subdistrict has historically had difficulty attracting a buyer due to its remoteness and its reputation for water-marked fish, however, this season a buyer was interested special periods. Since there were no biological indications why a limited harvest should not occur, an E.O. opened the subdistrict for a 24 hour period beginning on June 18 to test the chum and chinook run strength, feasibility of tendering the fish out of the area to a processing vessel, and the quality of the product. The runs appeared adequate to allow additional harvest, but the buyer was unhappy with the quality of the fish. The subdistrict did not open again until June 26 for 24 hours in order to

check the quality again. The chum salmon were water-marked but the flesh was firm and the period was extended an additional 24 hours. Two additional periods were opened by E.O. because the king salmon run strength in eastern Norton Sound was shown to be above average, with good escapement levels. The last period ended on July 5 with a total season commercial harvest for the subdistrict of 267 chinook, 290 pink, and 1,378 chum salmon (Tables 1 and 7).

#### Shaktoolik - Subdistrict 5

Both the Shaktoolik Subdistrict and the Unalakleet Subdistrict, located adjacent to the south boundary, consistently attract markets due to their larger volume of fish and better transportation services. Management actions often encompass both subdistricts because of their close proximity to one another and the fact that they have similar run timing abundance trends. However, there were several E.O's. issued this season that changed fishing times at the request of fish buyers who had to coordinate buying operations with tender vessels and cargo flights.

The first E.O. opened commercial fishing in the Shaktoolik and Unalakleet Subdistricts for a 24 hour period on June 14 allowing unlimited mesh size. That opening was followed by a second 24 hour period on June 17 for the same areas and gear. Comparative catches from the first two periods indicated a good chinook salmon return, therefore, both subdistricts were placed on a standard fishing schedule of two 24 hour periods per week beginning June 21 and continued with the open mesh size regulation. In addition, drift fishing was allowed which was intended to help fishermen avoid fowling their nets with debris which is common during the spring season. Both subdistricts were placed on the standard two 48 hour fishing periods per week on June 25 which continued through the remainder of the season.

On July 11 both subdistricts opened for a 36 hour period with a gear restriction of 4 1/2 inch mesh or smaller and reduced harvest areas. The Shaktoolik Subdistrict was restricted to that section of coast between the mouth of the Shaktoolik River east to the Foothills. Early indications of the chum salmon run showed a weak return. Therefore, on July 12 an E.O. continued those same parameters for the standard fishing schedule through July 31, after which gear restrictions would revert back to chum gear and harvest area would be extended out to the established subdistrict boundaries. There was one additional 24 hour pink salmon period added to the schedule which began on July 18.

The last two standard fishing periods in July were closed to help bolster chum salmon escapement and make up for the number of chum salmon that were caught as incidental species during the pink salmon directed fishing periods. Standard fishing periods and regulations were resumed through September, however, the last remaining fish buyer ceased operations in the subdistrict on August 24.

Two fish buyers operated in the Shaktoolik Subdistrict during the season. One buyer operated from a processing vessel and was primarily interested in purchasing pink salmon which were filleted using pollock processing equipment. The other species were purchased by both buyers, iced in the round, transported

to Unalakleet, and then shipped to Anchorage for further processing or for sale on the fresh market.

Thirty-seven fishermen harvested 2,757 chinook, 20 sockeye, 12,315 coho, 20,926 chum, and 106,743 pink salmon for a combined total commercial harvest of 142,761 fish (Tables 1 and 8). The chinook harvest was 98% above the previous 5 year average and 38% above the previous 10 year average catch. The coho salmon harvest was 36% and 46% above the previous 5 and 10 year average catches respectively. The chum salmon harvest was below both the previous 5 and 10 year averages at 15% and 21% respectively. A pink salmon harvest seldom occurs in the Shaktoolik Subdistrict with catches only reported three times in the previous 10 years. The 1993 pink harvest far exceeded all recorded seasons including the previous record catch in 1978 of 46,000 pinks.

#### Unalakleet - Subdistrict 6

The Unalakleet Subdistrict receives the most fishing effort in Norton Sound, and historically has not had problems obtaining buyers for all their salmon species with the exception of pink salmon. The commercial fishing management actions are typically the same as those for the Shaktoolik Subdistrict because of their close proximity (shared boundary) and the difficulty in obtaining timely escapement information. However, fishing times varied throughout the season to accommodate buyers and fishermen. The Unalakleet subsistence fishermen interviews and the Fish and Game test net in the Unalakleet River were used as indicators of salmon abundance and escapement in both Subdistricts 5 and 6.

The first fishing period began on June 14. It was a 24 hour period with unlimited mesh restrictions and was intended to test the run strength of the early portion of the chinook salmon return. Indications were good so a second 24 hour period was scheduled for June 17 and on June 21 the subdistrict was put on a standard schedule of two 24 hour periods per week. Drift-fishing was allowed in an attempt to avoid the large debris loads present in the water. Fishing time in the subdistrict increased on June 25 to two 48 hour periods per week and an E.O. was announced to restrict gear size to a six inch maximum mesh size on July 15 as required by regulation. The last two fishing periods of July were closed due to the low chum salmon escapement levels as indicated by the Department's aerial surveys and test net catches in the Unalakleet River. The subdistrict reopened on August 1 and the standard fishing schedule was shifted slightly to accommodate the only fish buyer operating in the area and the season ended on September 8.

There were two special pink salmon directed fishing periods scheduled during the regular season. These were at the request of a fish buyer who operated from a processing vessel which ran pink salmon through a pollock fillet machine. The first period began on July 11 and lasted 36 hours and the second period began on July 18 and lasted 24 hours. The same buyer also processed pinks that were caught incidentally during the regularly scheduled chum salmon directed periods. The remainder of the subdistrict's harvest was iced in the round and flown to Anchorage markets. In addition, a few fishermen sold some of their catches to individuals and local businesses as permitted under the catcher-seller regulations.

A total of 66 fishermen harvested 5,944 chinook, 251 sockeye, 26,290 coho, 42,061 pink, and 28,156 chum salmon for a total combined commercial harvest of 102,702 fish (Tables 1 and 9). The chinook salmon harvest was 45% above the previous 5 year average and 9% above the previous 10 year average catch. The coho harvest was 47% and 32% below the previous 5 and 10 year average catches, respectively. The chum salmon harvest was also 13% and 27% below their respective previous 5 and 10 year average catches. As stated earlier, pink salmon fisheries only take place occasionally. The pink harvest this year was 77% and 78% above the previous 5 and 10 average catches respectively.

## Escapement

Table 3 lists aerial survey and tower escapement counts in the major index streams of Norton Sound. Survey conditions varied throughout the district and were only fair this season overall. Heavy rains occurred during the peak survey dates for both chum and coho salmon species. Some early and late surveys were obtained for chums, but have limited value when comparisons are made with previous seasons. The Nome Subdistrict streams received the most intensive survey efforts because salmon stocks local to the Nome area are limited, easily accessed by road system, and exposed to intensive subsistence and sport fishing pressure. For these reasons a new counting tower project was begun on the Nome River. The project got a late start for chum and pink salmon this season. It is hoped that the project will also provide good background information on coho run timing and abundance for the Nome River in the future. The counting tower on the Kwiniuk River in the Moses Point Subdistrict operated as usual and had good counting conditions with no breaks in the regular counting schedule. The Unalakleet Test Fish Project also operated as usual and is a very important management tool particularly during seasons with marginal surveying conditions.

## Chinook

The Unalakleet and Shaktoolik Subdistricts are the primary chinook salmon producers in Norton Sound. Although on a smaller scale, the Norton Bay, Moses Point and Golovin Subdistricts have experienced gradually increasing chinook returns in recent years. Chinook salmon escapement surveys were well above average in the Unalakleet, Shaktoolik, and Moses Point Subdistricts. Daily subsistence fishermen interviews conducted at Unalakleet, the Departments test fish project in the Unalakleet River, and comparative commercial catch data agreed with the aerial survey results. However, chinook escapements were only average to slightly below average in the Golovin and Norton Bay Subdistricts.

#### Chum

Chum salmon escapements in the Nome Subdistrict were once again low at approximately 75% - 80% of the escapement goals. The Golovin Subdistrict is primarily a one river system with escapement goals set for individual tributaries. This season the chum salmon seemed to be redistributed with some tributaries well above goals and others well below, but as a combined system, escapement appeared adequate. The Moses Point Subdistrict was at about 80% of

its goal while the one stream in the Norton Bay Subdistrict which was surveyed had three times the escapement goal for chum salmon.

Early surveys in both the Shaktoolik and Unalakleet Subdistricts and the Department's test net catch in the Unalakleet River indicated either low or late chum runs. No peak surveys were obtained for either subdistrict, but by the end of the season the test net catch was near the cumulative average. Therefore, it is assumed that the run was somewhat late and the chum salmon escapement was adequate in both systems.

#### Coho

Coho salmon are found in nearly all of the chum producing streams throughout Norton Sound with the major commercial producers being the Unalakleet and Shaktoolik Subdistricts. Because of the inclement weather normally experienced in this area during August and September, escapement data for all subdistricts is somewhat sketchy. Most streams in the northern subdistricts were flown under fair to good conditions while the rest of Norton Sound was flown under poor conditions or not attempted due to unacceptable conditions.

Overall, coho salmon escapements appeared to be average. The 1993 season was the first year coho salmon had been enumerated from a counting tower on the Nome River. The data shows a substantial population, but there is nothing with which to compare it. Therefore, judging from the aerial surveys coho salmon escapements in the Nome Subdistrict were about average. The Golovin Subdistrict index streams were mixed with one well above average and the other well below. Overall, available data suggest an average coho escapement in the subdistrict. The Moses Point Subdistrict aerial surveys showed good escapements which agreed with the strong commercial catches in that subdistrict.

No peak coho surveys were obtained for the Norton Bay, Shaktoolik, or Unalakleet Subdistricts in 1993 due to poor conditions which may also have been the cause of the low commercial and test fishery catches. An early survey found good numbers of coho while catches had been low and, therefore, escapement was assumed to be adequate.

## Pink

Pink salmon returns to Norton Sound have recently followed an odd/even year cycle with the even years typically much larger than the odd years. This year the pink salmon escapement levels were believed to be one to two orders of magnitude below even year averages throughout the district. Pink salmon have a relatively short residence time in the rivers and are more easily washed out as a result of high water events similar to this year during the peak time period. Consequently, only adequate surveys were obtained for the Norton Bay and Shaktoolik Subdistricts, while the Kwiniuk River Tower provided reliable pink salmon counts.

#### Management Concerns

Chum salmon stocks have declined throughout Norton Sound over the past six years with escapements in the northern subdistricts continuing to be a major concern. Chum salmon escapements consistently fall short of goals even when all forms of harvest have been drastically reduced. The Nome Subdistrict closed nearly the entire chum run to sport, commercial and subsistence fishing. The Golovin Subdistrict planned on closing commercial harvest once a 10,000 chum cap was reached to allow for escapement, but with a commercial harvest of only 2,800 the subdistrict barely made its goals. Even though the Moses Point Subdistrict was closed to commercial and sport fishing and, for the first time ever, subsistence fishing was restricted, the subdistrict still fell short of its goals. Both the Shaktoolik and Unalakleet Subdistricts required closed commercial periods to bolster chum escapements up to the goals for each of the river systems. Only the Norton Bay Subdistrict exceeded its escapement goals, which was not unexpected because of the low level of exploitation typically observed in the subdistrict.

The low chum salmon returns are no longer simply single age class failures in Norton Sound. Chum returns can be expected to be low for the next several years since the returns will be coming from low parent years. Even the exceptionally restrictive management actions taken in 1993 failed to achieve escapement goals in many of the district river systems.

There has been a renewed interest in Norton Sound pink salmon this season where one fish buyer adapted his pollock processing equipment to fillet pinks. Fishing schedules and gear conflicts must be worked out in season because the abundant pink and marginal chum runs overlap in time and area. Management will have to monitor more closely the pink stocks which in most areas have been considered in the past as an incidental species in the harvest.

The Unalakleet Subdistrict has experienced a black market fishery for chinook salmon over the past several years. In order to maintain escapement and provide subsistence opportunity, the legitimate commercial fishery has been cut back by delaying the opening and keeping fishing periods to 24 hours in length. Subsistence fishing has been occasionally restricted during early summer to the lower section of the river in order to prevent the untraditional seining of pools where kings mill. More recently there have been complaints that coho salmon strips are now being illegally marketed outside of the local area. The illegal sale of salmon strips will continue to be a matter of concern in upcoming years.

#### 1994 Outlook

Run forecasts and harvest projections for the 1994 commercial salmon season are based on qualitative assessments of brood year returns, subjective determinations of fresh water over-wintering survival and ocean survival, and projections of local market conditions. Salmon buyers are expected to operate in some of the subdistricts of Norton Sound during 1994. The chinook return is expected to be below average. Chinook commercial harvests are expected to range from 4,000 to 6,000. Pink salmon are expected to be strong, especially since it will be an even year cycle. In recent years, there has been little market for Norton Sound pink salmon, but a market for up to a million pink salmon is expected during

1994. Given this market and a typical even year return the pink salmon harvest could be significant. Chum and coho salmon escapements were not observed during the 1994 brood's parent year (1989 and 1990) due to high water and inclement weather conditions. A weak return of chum salmon is expected, but an average return of coho is expected. Harvests of chum are expected to range from 50,000 to 80,000. Commercial coho harvests are expected to range from 40,000 to 60,000.

Table 1. Norton Sound commercial salmon catch by subdistrict, 1993.

Subdistrict	Chinook	Sockeye	Coho	Pink	Chum	Total
Nome	0	0	611	0	132	743
Golovin	1	4	2	8,480	2,803	11,290
Moses Point	3	4	4,065	0	167	4,239
Norton Bay	267	0	0	290	1,378	1,935
Shaktoolik	2,757	20	12,315	106,743	20,926	142,761
Unalakleet	5,944	251	26,290	42,061	28,156	102,702
District						
Totals	8,972	279	43,283	157,574	53,562	263,670

Table 2. Nome area subsistence salmon catches, Norton Sound, 1993.

	Num	oer of Per	mits	Number of Salmon Harvested							
	Issued	Returned	Fished	Chinool	c Sockeye	Coho	Pink	Chum	Total		
Marine Waters	68	58	36	48	43	869	202	1,610	2,772		
Nome River	24	19	12	0	7	229	442	55	733		
Snake River	6	6	6	2	0	81	11	17	111		
Eldorado River	11	10	8	1	3	346	2	32	384		
Flambeau River	5	4	4	0	1	224	2	. 8	235		
Bonanza River	6	5	2	0	1	49	5	10	65		
Safety Sound	0	0	0	0	0	0	0	0	0		
Solomon River	5	5	3	0	0	0	190	1	191		
Penny River	0	0	0	0	0	0	0	0	0		
Cripple Creek	0	0	0	0	0	0	0	0	0		
Sinuk River	2	1	0	0	0	0	0	0	0		
Feather River	0	0	0	0	0	0	0	0	0		
Fish River	1	1	1	0	0	272	0	8	280		
Niukluk River	0	0	0	0	0	0	0	0	0		
Port Clarence	2	2	2	1	25	0	19	25	70		
Kuzitrin River	0	0	0	o*	0	0	0	0	' 0		
Pilgrim River	8	4	0	0	0	0	0	0	0		
Unknown River	3	0	0	0	0	0	0	Ô	0		
Total	141	115	74	52	80	2,070	873	1,766	4,841		

Table 3. Salmon survey counts of Norton Sound streams and associated chum salmon escapement goals, 1993.ab

	01:		0 1	<b>C</b> : 1.		Chum
Stream Name	Chinook	Coho	Sockeye	Pink	Chum	Goal
Salmon L.			3,101	-		
Glacial L.			419			
Sinuk R.	7	104	30	5,120	1,570	4,500
Cripple R. Penny R.						
Snaké R.	•				317	1,000
Nome R.	56 <sup>c</sup>	3,061°		9,212 <sup>c</sup>	1,520	2,000
Flambeau R.					1,590	3,250
Eldorado R.	38	110		120	2,885	5,250
Bonanza R.		510				1,500
Solomon R.		128		900	415	550
Fish R.	48			13,440	12,695	17,500
Boston Cr.	227			1,930	4,513	2,500
Niukluk R.	15	2,104		2,840	19,910	8,000
Ophir Cr.		14				
Kwiniuk R.	565 <sup>c</sup>	1,238		43,065 <sup>c</sup>	15,823 °	19,500 <sup>d</sup>
Tubutulik R.	1,061	1,395		18,650	8,740	12,000
Inglutalik R.						8,500
Ungalik R.	156			66,120	10,180	2,500
Shaktoolik R.	712			85,320	5,515	11,000
Unalakeet R.	253					
North R. Old Woman R.	900	1,397		13,570	445	2,000 100
Kogok R.		115		70	70	
Pikmiktalik R.		525			150	

<sup>&</sup>lt;sup>a</sup> Species identification difficult where large numbers of pinks salmon were observed.

<sup>&</sup>lt;sup>b</sup> Counts should be considered minimums due to variable counting conditions.

Expanded tower counts.
 Chum goal for expanded tower count.

Table 4. Commercial salmon catches from Nome, Subdistrict 1, Norton Sound, set gillnets, 1993.

Deviced	Davis	11	N= -4	<u>P</u>	eriod Catch and C	atch Pe	r Unit Effo	ort		<u>(</u>	Cumulative Ca	itch and C	atch Per L	Init Effort	
Period Number	Period Dates	Hours Fished	No. of Fishermen	Chinook	Sockeye	Coho	CPUE	Chum	CPUE	Chinook	Sockeye	Coho	CPUE	Chum	CPUE
1	8/02-8/03	24	0	NO ONE FISHED	TOO ROUGH										
2	8/05-8/06	24	0	NO ONE FISHED	TOO ROUGH										
3	8/09-8/10	24	1	0	0	373	15.54	25	1.04	0	0	373	15.54	25	1.04
4	8/12-8/13	24	0	NO ONE FISHED	TOO ROUGH					0	0	373	15.54	25	1.04
5	8/16-8/17	24	1	0	0	38	1.58	34	1.42	0	0	411	8.56	59	1.23
6	8/19-8/20	24	0	NO ONE FISHED	STORMY					0	. 0	411	8.56	59	1.23
7	8/23-8/24	24	1	0	2	78	3.25	52	2.17	0	2	489	6.79	111	1.54
8	8/26-8/27	24	1	0	0	122	5.08	21	0.88	0	2	611	6.36	132	1.38
9	8/30-8/31	24	0	NO ONE FISHED	TOO ROUGH					0	2	611	6.36	132	1.38

All salmon sold as permited under Catcher/Seller status.

No pink salmon were sold.

Total hours fished = 96

Total number of permits used = 1

Table 5. Commercial salmon catches from Golovin, Subdistrict 2, Norton Sound, set gillnets, 1993.

					Period Ca	tch and Cat	ch Per Uni	t Effort				C	umulative Ca	atch and C	atch Per L	Init Effort	
Period Number	Period Dates	Hours Fished	No. of Fishermen	Chinook	Sockeye	Coho	Chum	CPUE	Pink	CPUE	Chinook	Sockeye	Coho	Chum	CPUE	Pink	CPUE
1	7/13-7/14	24	4	0	1	0	290	3.02	885	9.22	0	1	0	290	3.02	885	9.22
2	7/16-7/17	36	8	0	3	0	1,357	4.71	3,559	12.36	0	4	0	1,647	4.29	4,444	11.57
3	7/22-7/23	24	7	1	0	2	1,156	6.88	4,036	24.02	1	4	2	2,803	5.08	8,480	15.36

Total hours actually fished = 84
Total number of permits used = 8

Table 6. Commercial salmon catches from Moses Point, Subdistrict 3, Norton Sound, set gillnets 1993.

D	Destad	11	No. of	<u>Perio</u>	od Catch and	Catch Pe	r Unit Effo	<u>rt</u>		Cumul	ative Catch a	nd Catch	per Unit E	<b>Effort</b>	
Period Numbe	Period er Dates	Hours Fished	No. of Fishermen	Chinook	Sockeye	Coho	CPUE	Chum	CPUE	Chinook	Sockeye	Coho	CPUE	Chum	CPUE
1	8/06-8/07	24	16	1	2	537	1.4	41	0.11		2			41	0.03
2	8/10-8/12	48	21	2	1	1,921	1.91	77	0.08	3	3	2,458	1.77	118	0.08
3	8/17-8/18	24	18	0	0	879	2.03	35	0.08	3	3	3,337	1.83	153	0.08
4	8/26-8/27	24	13	0	1	709	1.60	14	0.04	3 .	4	4,065	1.86	167	80.0

Number of hours actually fished = 120 Number of permits used = 26 26 fishermen sold 2,608 pounds of roe which were recovered from same fish reported in catch.

Table 7. Commercial salmon catches from Norton Bay, Subdistrict 4, Norton Sound, set gillnets, 1993.

Desired	Destant	11	No. of	ļ	Period Ca	atch and Ca	atch Per U	nit Effort		Cui	mulative C	atch and	Catch Pe	r Unit Effo	<u>ort</u>
Period Numbe	Period er Dates	Hours Fished	No. of Fishermen	Chinook	CPUE	Pink	CPUE	Chum	CPUE	Chinook	CPUE	Pink	CPUE	Chum	CPUE
1	6/17-6/18	24	6	31	0.22			1	0.01	31	0.22	0	0.00	1	0.01
2	6/26-6/28	48	13	178	0.29	9	0.01	391	0.63	209	0.27	9	0.01	392	0.51
3	6/30-7/01	24	13	36	0.12	84	0.27	455	1.46	245	0.23	93	0.09	847	0.78
4	7/03-7/05	48	9	22	0.05	197	0.46	531	1.23	267	0.18	290	0.19	1,378	0.91

Total number of hours fished = 144

Total number of permits fished = 15

Norton Bay subdistrict closed by Emergency Order on July 5 due to a lack of buyers in the area.

Table 8. Commercial salmon catches from Shaktoolik, Subdistrict 5, Norton Sound, set gillnets, 1993.

D / 1	D. J. J		<b>N</b> 14		Ē	eriod Catch	and Cat	ch Per U	nit Effort					9	Cumulative C	Catch and	Catch F	Per Unit Eff	ort		
Period Number	Period Dates	Hours Fished	No. of Fishermen	Chinook	CPUE	Sockeye	Coho	CPUE	Chum	CPUE	Pink	CPUE	Chinook	CPUE	Sockeye	Coho	CPUE	Chum	CPUE	Pink	CPUE
1	6/14-6/15	24	13	192	0.62				20	0.06			192	0.62				20	0.06	0	0.00
	6/17-6/18	24	18	464	1.07				161	0.37			656	0.88				181	0.24	ō	0.00
	6/21-6/22		25	562	0.94				607	1.01	1	0.00	1,218	0.91	0			788	0.59	1	0.00
	6/24-6/26	48	29	886	0.64	0	0	0.00	2.096	1.51	72	0.05	2,104	0.77	ō			2,884	1.05	73	0.03
	6/28-6/30	48	29	401	0.29	ő	ō	0.00	4,035	2.90	70	0.05	2,505	0.61	ō			6,919	1.68	143	0.03
	7/01-7/03	48	28	152	0.11	Ö	ō	0.00	4.610	3.43	904	0.67	2,657	0.49	ō			11,529	2.11	1,047	0.19
	7/05-7/07	48	27	. 55	0.04	Ö	1	0.00	3,273	2.53	11,183	8.63	2,712	0.40	Ō	1		14,802	2.19	12,230	1.81
	7/08-7/10		17	10	0.01	1	Ó	0.00	515	0.63	2,990	3.66	2,722	0.36	. i	1		15,317	2.02	•	2.01
	7/11-7/12		19	8	0.01	1	ō	0.00	631	0.92	21,046	30.77	2,730	0.33	2	i		15,948	1.93	36,266	4.39
	7/12-7/14	48	22	4	0.00	Ó	1	0.00	465	0.44	18,663	17.67	2,734	0.29	2	2		16,413	1.76	54,929	5.89
	7/15-7/17	48	27	4	0.00	1	8	0.01	832	0.64	34,014	26.25	2,738	0.26	3	10		17,245	1.62	88,943	8.38
	7/18-7/19	24	11	Ó	0.00	0	4	0.02	458	1.73	6,229	23.59	2,738	0.25	3	14		17,703	1.63	95,172	8.74
13	7/19-7/21	48	25	4	0.00	3	8	0.01	981	0.82	6,999	5.83	2,742	0.23	6	22		18,684	1.55	102,171	8.46
14	7/22-7/24	48	9	0	0.00	1	5	0.01	308	0.71	4,572	10.58	2,742	0.22	7	27		18,992	1.52	106,743	8.53
15	7/26-7/28	Period (	Closure																		
16	7/29-7/31	Period (	Closure					_													
17	8/01-8/03	48	0	NO BUYER									2,742		7	27		18,992	1.52	106,743	
18	8/04-8/06	48	15	1	0.00	2	1,406	1.95	441	0.61			2,743		9	1,433	1.99	19,433	1.47	106,743	
19	8/08-8/10	48	16	7	0.01	4	2,446	3.18	711	0.93			2,750		13	3,879	2.61	20,144	1.44	106,743	
20	8/11-8/13	48	19	4	0.00	3	4,146	4.55	523	0.57			2,754		16	8,025	3.34	20,667	1.39	106,743	
21	8/15-8/17	48	14	0	0.00	0	494	0.74	81	0.12			2,754		16	8,519	2.77	20,748		106,743	
22	8/18-8/20	48	0	NO ONE FIS	SHED - S	STORMY							2,754		16	8,519	2.77	20,748	1.33	106,743	
23	8/22-8/24	48	13	2	0.00	4	2,611	4.18	116	0.19			2,756		20	11,130	3.01	20,864		106,743	
24	8/25-8/27	48	9	1	0.00	0	1,185	2.74	62	0.14			2,757		20	12,315	2.98	20,926	1.26	106,743	
25	8/29-8/31	48	0	NO BUYER									2,757		20	12,315		20,926		106,743	
26	9/01-9/03	48	0	NO BUYER									2,757		20	12,315		20,926		106,743	
27	9/06-9/08	48	0	NO BUYER									2,757		20	12,315		20,926		106,743	

Total hours actually fished = 852 Total number of permits used = 37

Cumulative coho boat hours began when 100 coho were caught.

Table 9. Commercial salmon catches from Unalakleet, Subdistrict 6, Norton Sound, set gillnets, 1993.

						Period Cat	ch and (	Catch Pe	r Unit Eff	ort					Cumulative	Catch	and Catc	h Per Unit	Effort		
Period Number	Period Dates	Hours Fished	No. of Fishermen	Chinook	CPUE	Sockeye	Coho	CPUE	Chum	CPUE	Pink	CPUE	Chinook	CPUE	Sockeye	Coho	CPUE	Chum	CPUE	Pink	CPUE
	6/14-6/15	24	31	802	1.08	1			26	0.03			802	1.08	1	0		26	0.03		
2	6/17-6/18	24	41	543	0.55	Ö			40	0.03			1,345	0.78	,	0		66	0.03		
3	6/21-6/22	24	33	680	0.86	0			116				2,025	0.80	;	0		182	0.07		
4	6/24-6/26	48	47	1,682		1	1	0.00	498	0.13	1	0.00	3,707	0.78	,	1		680	0.14	1	0.00
5	6/28-6/30	48	48	1,076	0.47	11	'n	0.00	3,602		9	0.00	4,783	0.78	13	1		4,282	0.60	10	0.00
6	7/01-7/03	48	49	592	0.47	6	2	0.00	4,337	1.84	139	0.06	5,375	0.57	19	3		8,619	0.91	149	0.00
7	7/01-7/03	48	43	269	0.13	24	0	0.00	3.634	1.76	1,535	0.74	5,644	0.49	43	3		12,253	1.07	1,684	0.02
, α	7/03-7/07	48	34	99	0.06	8	2	0.00	2,196		1,246	0.76	5,743	0.44	51	5		14,449	1.10	2,930	0.13
٥	7/11-7/12	24	18	8	0.02	7	1	0.00	620	1.44	11,703	27.09	5,751	0.42	58	6		15,069	1.11	14,633	1.08
10	7/12-7/14	48	28	43	0.02	19	8	0.01	1,393		7,684	5.72	5,794	0.39	77	14		16,462	1.10	22,317	1.50
11	7/15-7/17	48	29	44	0.03	57	30	0.02	3,212		9,029	6.49	5,838	0.36	134	44		19,674	1.21	31,346	1.92
12	7/18-7/19	24	8	4	0.02	7	24	0.13	554	2.89	6.417		5,842	0.35	141	68		20,228	1.23	37,763	2.29
13	7/19-7/21	48	33	22	0.01	18	74	0.05	2,252	1.42	2,516		5,864	0.32	159	142	0.01	22,480	1.24	40,279	2.23
14	7/22-7/24	48	26	21	0.02	13	156	0.13	2,309	1.85	1,782	1.43	5,885	0.30	172	298	0.02	24,789	1.28	42,061	2.18
15	7/26-7/28	Period (	_		0.02			•	_,		,,		0,000				0.02	,,		,	
16	7/29-7/31																				
17	8/01-8/03	48	6	3	0.01	4	92	0.32	140	0.49			5,888		176	390	0.03	24,929	1.27	42.061	
18	8/04-8/06	48	32	9	0.01	20	2,047	1.33	986	0.64			5,897		196	2,437	0.15	25,915	1.23	42,061	
19	8/08-8/10	48	38	9	0.00	21	4,790	2.63	636	0.35			5,906		217	7,227	0.40	26 551	1.16	42,061	
20	8/11-8/13	48	42	13	0.01	12	4,403	2.18	608	0.30			5,919		229	11,630	0.58	27,159	1.09	42,061	
21	8/15-8/17	48	30	7	0.00	5	3,401	2.36	372	0.26			5,926		234	15,031	0.69	27,531	1.04	42,061	
22	8/18-8/20	48	12	1	0.00	5	880	1.53	98	0.17			5,927		239	15,911	0.72	27,629	1.02	42,061	
23	8/22-8/24	48	21	5	0.00	4	2,141	2.12	202	0.20			5,932		243	18,052	0.78	27,831	0.99	42,061	
24	8/25-8/27	48	21	6	0.01	3	2,263	2.25	165	0.16			5,938		246	20,315	0.84	27,996	1.00	42,061	
25	8/29-8/31	48	20	4	0.00	3	3,359	3.50	73	0.08			5,942		249	23,674	0.94	28,069	0.97	42,061	
26	9/01-9/03	48	19	1	0.00	2	1,814	1.99	70	0.08			5,943		251	25,488	0.98	28,139	0.94	42,061	
27	9/06-9/08	48	15	1	0.00	0	802	1.11	17	0.02			5,944		251	26,290	0.98	28,156	0.92	42,061	

Total hours fished = 1080
Total number of permits used = 66
Cumulative coho boat hours began when 100 coho were caught.

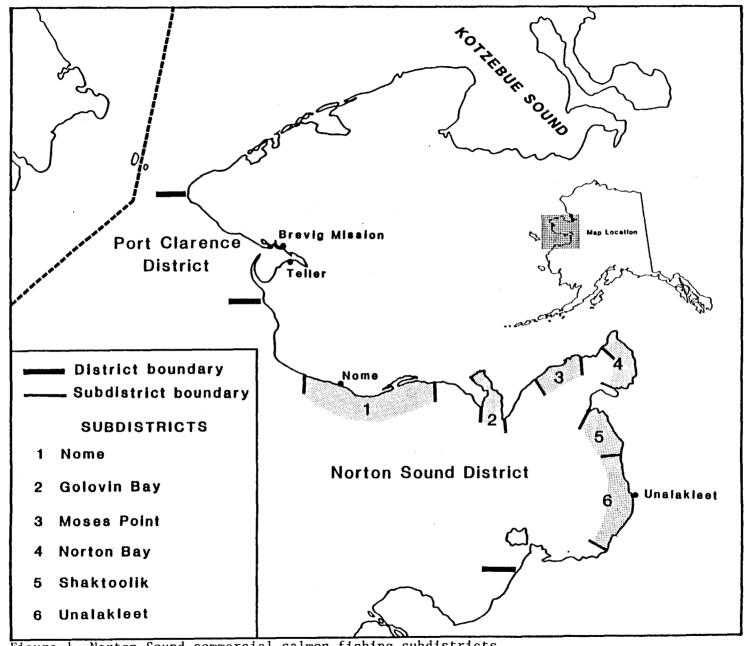


Figure 1. Norton Sound commercial salmon fishing subdistricts.

Appendix Table Al. Number of commercial salmon fishermen fishing in Norton Sound, 1970-1993.

		_	SUBDIS		_	_	DISTRICT a
<u>Year</u>	l	2	3	4	5	6	<u>Totals</u>
Year 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985	1 6 7 20 21 25 24 21 14 16 15 18 19 8	33 22 20 34 25 42 22 25 24 21 17 19 17 21 22 21	SUBDIS 3 21 45 48 57 60 67 54 52 44 41 26 33 28 39 25 34	0 6 32 30 8 42 27 24 26 22 13 10 10 15 8	12 19 20 27 23 39 37 30 26 29 26 26 32 34 24 21	45 72 71 94 53 61 60 45 51 63 66 73 68 72 74	DISTRICT a Totals  b b b b b b b b b b b b b b b b b b b
1986 1987 1988 1989 1990 1991 1992 1993	13 10 5 2 0 0 2 1	24 21 21 0 15 16 1	34 36 13 23 24 21 26	9 12 13 0 0 0 9	30 39 21 26 28 25 25 37	73 65 69 73 73 75 71 66	163 164 152 110 128 126 110 153

District total is the number of fishermen that actually fished in Norton Sound; some fishermen may have fished more than one subdistrict.

<sup>&</sup>lt;sup>b</sup> Data not available.

NOME (SUBDISTRICT 1)

			С	ommercia	i					Subsisten	e				I	Combined			
	Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
	1964	5	_	_	1	1194	1200	_			_	_	_	5	_	_	1	1194	1200
	1965	1	_	_	193	1941	2135	_		_	780	1825	2605	1	-	_	973	3766	4740
	1966	i	_	32	1	581	615	12		192	1794	1762	3760	13	_	224	1795	2343	4375
	1967		_	_	72	406	478	11		36	349	627	1023	11	_	36	421	1033	1501
	1968	_		_	50	102	152	7		108	6507	621	7243	7	_	108	6557	723	7395
	1969	_		63	330	601	994	2		27	3649	508	4186	2	_	90	3979	1109	5180
	1970		_	6	55	960	1021	_		25	5001	458	5494			44	FOER	4440	0545
	1971	11	_	-	14	2315	2340	_		35 122	5457	2900	8479	0		41	5056	1418	6515
	1972	15	_	_	12	2643	2670	19		52	4684	315	5070	1		122 52	5471	5215	10819
	1973	-	_	_	321	1132	1453	14		120	5108	1863	7105	34	_		4696	2958	7740
	1974	19	_	123	7722	10431	18295	8		5	3818	183	4014	14 27	_	120 128	5429 11540	2995 10614	8558
	1975	2	_	319	2163	8364	10293	2		97	6267	2858	9224	4		416	8430	11222	22309 20072
	1976	2	10	26	1331	7620	8989	13		189	5492	1705	7399	15	10	215	6823	9325	16388
	1977	8	-	58	65	15998	16129	35		498	2773	12192	15498	43		556	2838	9325 28190	31627
	1978	19	_	-	22869	8782	31670	35		225	13063	4295	17618	54	_	225	35932	13077	49288
	1979	9	_	29	5860	5391	11289	11		1120	6353	3273	10757	20	_	1149	12213	8664	22046
	(8/8	•	_	28	3600	5391	11209	! ''		1120	0333	32/3	10/5/	20		1148	12213	8004	22040
	1980	8	-	-	10007	13922	23937	129		2157	22246	5983	30515	137	-	2157	32253	19905	54452
	1981	4	-	508	3202	18666	22380	35	14	1726	5584	8579	15938	39	14	2234	8786	27245	38318
	1982	20	_	1183	18512	13447	33162	21	6	1829	19202	4831	25889	41	6	3012	37714	18278	59051
	1983	23		261	308	11691	12283	74	53	1911	8086	7091	17215	97	53	2172	8394	18782	29498
	1984	7	-	820	_	3744	4571	83	16	1795	17182	4883	23959	90	16	2615	17182	8627	28530
w	1985	21		356	_	6219	6596	56	114	1054	2117	5667	9008	77	114	1410	2117	11886	15604
30	1986	6	_	50	_	8160	8216	150	107	688	8720	8085	17750	156	107	738	8720	16245	25966
	1987	3		577		5646	6226	200	107	1100	1251	8394	11052	203	107	1677	1251	14040	17278
	1988	2	_	54	182	1628	1866	63	133	1076	2159	5952	9383	65	133	1130	2341	7580	11249
	1989	2	-	-	123	492	617	24	131	469	924	3399	4947	26	131	469	1047	3891	5564
	1990	0	_	0	0	0	0	58	234	510	2233	4246	7281	58	234	510	2233	4246	7281
	1991	0	0	0	0	0	0	83	166	1279	194	3715	5437	83	166	1279	194	3715	5437
	1992	1	2	. 693	185	881	1762	152	163	1481	7351	1684	10831	153	165	2174	7536	2565	12593
	1993	0	2	611	0	132	745	52	80	2070	873	1766	4841	52	82	2681	873	1898	5586
	5-vear																		
	avg. *	1	_	149	98	600	849	76	165	963	2572	3799	7576	77	166	1112	2670	4399	8425
	10-year																		
	avg <sup>b</sup>	7	_	281	80	3846	4214	94	122	1136	5022	5312	11686	101	123	1417	5102	9158	15900

<sup>&</sup>quot; 1988—1992 <sup>b</sup> 1983—1992

**GOLOVIN BAY (SUBDISTRICT 2)** 

			C	Commercial	ļ				5	Subsistend	e					Combined			
	Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook S	ockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
	1962	45	11	264	10276	68720	79316	_	_	_	<del></del>	_	_	45	11	264	10276	68720	79316
	1963	40	40	_	19677	49850	69607	-	_	118	5702	9319	15139	40	40	118	25379	59169	84746
	1964	27	40	3	7236	58301	65607	-		_	_		_	27	40	3	7236	58301	65607
	1965	-	_	_	_	_	_	2	-	49	1523	3847	5421	2		49	1523	3847	5421
	1966	17	14	584	4665	29791	35071	4	_	176	1573	3520	5273	21	14	760	6238	33311	40344
	1967	10	_	747	5790	31193	37740	3		185	2774	4803	7765	13	_	932	8564	35996	45505
	1968	12	_	205	18428	10011	28656	4	-	181	4955	1744	6884	16	-	386	23383	11755	35540
	1969	28	-	1224	23208	20949	45409	2	-	190	2760	2514	5466	30	_	1414	25968	23463	50875
	1970	13	_	3	18721	20566	39303	4	_	353	2046	2614	5017	17	_	356	20767	23180	44320
	1971	37	_	197	2735	33824	36793	7	_	191	1544	1936	3678	44		388	4279	35760	40471
	1972	36	-	20	6562	27097	33715	4	-	62	1735	2028	3829	40	_	82	8297	29125	37544
	1973	70		183	14145	41689	56087	1		48	9	74	132	71	_	231	14154	41763	56219
	1974	30	, <del>-</del>	3	28340	30173	58546	3	-	-	967	205	1175	33	_	3	29307	30378	59721
	1975	17	_	206	10770	41761	52754	_		1	2011	2025	4037	17		207	12781	43786	56791
	1976	12	_	1311	24051	30219	55593	_	_	-	1995	1128	3123	12	_	1311	26046	31347	58716
	1977	26		426	7928	53912	62292	3	-	80	703	2915	3701	29	-	506	8631	56827	65993
	1978	22	_	94	72033	41462	113611	1	_	_	2470	1061	3532	23	-	94	74503	42523	117143
	1979	75	49	1606	45948	30201	77879	-	_	845	2546	2840	6231	75	49	2451	48494	33041	84110
	1980	36	36	328	10774	52609	63783	12	_	692	10727	4057	15488	48	36	1020	21501	56666	79271
	1981	23	5	13	49755	58323	108119	8	_	1520	5158	5543	12229	31	5	1533	54913	63866	120348
31	1982	78	5	4281	39510	51970	95844	7		1289	4752	1868	7916	85	5	5570	44262	53838	103760
•	1983	52	10	295	17414	48283	66054	_	_	_	-	-	_ °	-	_	_	-	-	_
	1984	31		2462	88588	54153	145234		_		-		c						
	1985	193	113	1196	3019	55781	60302	12	2	430	1904	9577	11925	205	115	1626	4923	65358	72227
	1986	8181	8	958	25425	69725	104297	-	-	-	-		_ c	-	-	-		***	
	1987	166	51	2203	1579	44334	48333	_	-	-	_	-	_ 6	_	_	_	-	_	<del>-</del>
	1988	108	921	2149	31559	33348	68085	-	-	-		_	_ c	_		_	_	-	_
	1989	0	0	0	0	0	.0	_	_	_	_	_	_,	-	-	_	_	_	_
	1990	52	21	0	0	15993	16066	-	_	_	_	_	_ c	_	-	_	-	_	_
	1991	49	1	0	0	14839	14889	-	-	-	_	_	_ c	-	_	-	-	-	_
	1992	6	9	2085	0	1002	3102	-	_		_	-	- c	-	_		_	-	_
	1993	1	4	2	8480	2803	11290		<u>- · · · · · · · · · · · · · · · · · · ·</u>				_ c	-	**				
5-ye																			
avg. *	ı	43	-	847	6312	13036	20428	_	_	-	-	_	_	_	_	-	-	-	
10-y	ear																		
avg <sup>6</sup>		884	-	1135	16758	33746	52636	-			-	-	-	-		-	-	_	

<sup>&</sup>lt;sup>1</sup> 1988-1992 <sup>1</sup> 1983-1992

<sup>&</sup>lt;sup>c</sup> Subsistence survey not conducted.

MOSES POINT (SUBDISTRICT 3)

			c	Commercial					;	Subsistenc	e					Combined			
	Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
	1962	27	_		11100	50683	61810	_	-		_		_	27	0	0	11100	50683	61810
	1963	15	_	_	2549	46274	48838	5	_	_	5808	8316	14129	20	Ŏ	ő	8357	54590	62967
	1964	32	3	_	3372	28568	31975	-	_	-	63	348	411	32	3	Ö	3435	28916	32386
	1965	-	_		-		-	16	_	72	1325	9857	11270	16	_	72	1325	9857	11270
	1966	17	_	_	2745	24741	27503	14	-	250	2511	5409	8184	31	0	250	5256	30150	35687
	1967			_		27/71	27500	39	_	116	1322	9913	11390	39	_	116	1322	9913	11390
	1968	12	_	1	9012	17908	26933	2		80	6135	2527	8744	14		81	15147	20435	35677
	1969	29	_		11807	26594	38430	9	_	109	1790	1303	3211	38	-	109	13597	27897	41641
	1909	29	_	_	11007	20094	30430	9	_	109	1790	1303	3211	36	-	109	13351	21091	41041
	1970	39	_	_	13052	29726	42817	16	_	160	4661	6960	11797	. 55	-	160	17713	36686	54614
	1971	95	_	4	922	43831	44852	16	-	271	1046	2227	3560	111	-	275	1968	46058	48412
	1972	190	_	11	5866	30919	36986	44	-	108	1579	2070	3801	234		119	7445	32989	40787
	1973	134	_	_	10603	31389	42126	2	-	_		298	300	136	-	0	10603	31687	42426
	1974	198	-	9	12821	55276	68304	3	-	_	2382	1723	4108	201	_	9	15203	56999	72412
	1975	16		-	4407	46699	51122	2	-	6	1280	508	1796	18	_	6	5687	47207	52918
	1976	24	-	232	5072	10890	16218	22	_	-	5016	1548	6586	46	_	232	10088	12438	22804
	1977	96	_	6	9443	47455	57000	22	-	225	1145	1170	2562	118	_	231	10588	48625	59562
	1978	444		244	39694	44595	84977	38	-	407	1995	1229	3669	482		651	41689	45824	88646
	1979	1035	_	177	40811	37123	79146	16	-	890	6078	1195	8179	1051	0	1067	46889	38318	87325
	1980	502	_		1435	14755	16692	131	_	229	4232	1393	5985	633	0	229	5667	16148	22677
	1981	198	_	5	26417	29325	55945	32	-	2345	6530	2819	11726	230	0	2350	32947	32144	67671
32	1982	253	_	318	9849	40030	50450	1	_	1835	3785	3537	9158	254	0	2153	13634	43567	59608
10	1983	254	_	_	17027	65776	83057	-	_	_	-	_	— c	_	_	_	-	_	-
	1984	-	_	5959	28035	9477	43471	_	_	_	-	_	_ c	-	-	_	-		_
	1985	816	32	1803	559	24466	27676	67	-	1389	1212	947	3615	883	32	3192	1771	25413	31291
	1986	600	41	5874	15795	20668	42978	-	-	_	-	_	_ c	-	_	_	_	-	-
	1987	907	15	64	568	17278	18832	-	-	_	-	_	_ c	-	_	_	_	_	-
	1988	663	93	3974	13703	18585	37018	_	-	_	-	-	- c	-	_	_	_	_	_
	1989	62	. <del>-</del>	_	-	167	229	_	-		_	-	- c	_	_	_		_	_
	1990	202	_	_	501	3723	4426	_	_	_		_	_ c	-	-	_	_	-	_
	1991	161	0	0	0	804	965	312	-	2153	3555	2660	8680 <sup>d</sup>	473	_	2153	3555	3464	9645
	1992	0	0	3531	0	6	3537	100	_	1281	6152	1260	8793 <sup>d</sup>	100	_	4812	6152	1266	12330
	1993	3	0	4065	0	167	4235	368	_	1217	1726	1635	4946 <sup>d</sup>	371	_	5282	1726	1802	9181
5-ye		<del>-</del> -																	
avg.	•	218	19	1501	2841	4657	9235	_	-	-	_	-	-	-	-	_	-	-	-
10-y avg <sup>b</sup>		367	18	2121	7619	16095	26219	-	_	-	_	_	_	-	-		_	-	-

<sup>\* 1988-1992</sup> 

<sup>&</sup>lt;sup>b</sup> 1983-1992

<sup>&</sup>lt;sup>c</sup> Subsistence survey not conducted.
<sup>d</sup> Subsistence survey conducted by Subsistence Division.

NORTON BAY (SUBDISTRICT 4)

			C	Commercial						Subsistenc	e				ı	Combined			
	Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
	1962	387	7	40	4402	24380	29216	_	_		_	_		387	7	40	4402	24380	29216
	1963	137	2	_	17676	12469	30284	_	_	_	5097	_	5097	137	2	_	22773	12469	35381
	1964	50	3	_	988	5916	6957	_	_	_	_	_		50	3	_	988	5916	6957
	1965	_	_	-		_	-	4		22	252	3032	3310	4	_	22	252	3032	3310
	1966	_	_	_	_		_	7	-	41	929	3612	4589	7	_	41	929	3612	4589
	1967	_	_	_	_		-	12		14	1097	2945	4068	12	_	14	1097	2945	4068
	1968		_	_	-	_	_	28	_	71	1916	1872	3887	28	-	71	1916	1872	3887
	1969	26	-	-	4849	3974	8849	59		189	2115	3855	6218	85	_	189	6964	7829	15067
	1970	-			_		_	3	_	10	840	3500	4353	3	_	10	840	3500	4353
	1971				_	_		5	-	47	92	2619	2763	5	-	47	92	2619	2763
	1972	43	_	_	1713	7799	9555	30		44	2089	2022	4185	73	-	44	3802	9821	13740
	1973	28	_	_	1645	4672	6345	1	_	_	10	130	141	29	-		1655	4802	6486
	1974	21		_	654	3826	4501	-	_	_	17	900	917	21	-	-	671	4726	5418
	1975	68	_	89	1137	17385	18679	1	_	-	93	361	455	69	-	89	1230	17746	19134
	1976	102	_	95	4456	7161	11814	2	-	-	41	236	279	104		95	4497	7397	12093
	1977	158		1	2495	13563	16217	14	-	-	420	2055	2489	172	_	1	2915	15618	18706
	1978	470	_	144	8471	21973	31058	12	_	21	1210	1060	2303	482	-	165	9681	23033	33361
	1979	856	_	2547	6201	15599	25203	12	_	697	735	1400	2844	868	_	3244	6936	16999	28047
	1980	340	_	_	47	7855	8242	22	_	33	4275	1132	5462	362	_	33	4322	8987	13704
	1981	63	-	_	177	3111	3351	7	_	82	2314	3515	5918	70	_	82	2491	6626	9269
ည္ထ	1982	96	_	2332	2535	7128	12091	1	_	484	2600	2485	5570	97	_	2816	5135	9613	17661
ω	1983	215	_	204	3935	17157	21511	-	-	_			_ c	_	_		_	_	_
	1984	_		- <del>-</del>	1162	3442	4604	-	_	-	_	-	_ c	-	_		_	_	_
	1985	528	_	384	68	9948	10928	-	-	_	_	_	_ c _ c			_	_	_	***
	1986	139	2	1512	40	1994	3687	_	-	<del>-</del>	-	_	_ c	_		. —	_	_	
	1987	544	_	145	16	3586	4291	-	-			. –	_ c	_	_	-	_	_	_
	1988	434	2	709	1749	7521	10415	_	_	_	_	_	_ c	_	-	_	•••	_	_
	1989	0	0	0	Ο.	0	0	-		_	_	_	•	_	-	_	_	_	_
	1990 <sup>d</sup>	0	0	0	0	0	0	-	_		_	_	_ c	-	_	_	_	_	
	1991 <sup>d</sup>	0	0	0	0	0	0	-	_			_	_ c	_	_	_	-	_	_
	1992	27	0	0	0	1787	1814	_	_	_		_	_ c	_	_		-	_	_
	1993	267	0	0	290	1378	1935		-	_	_	_	_ c	_	_	_		_	_
5-ye	er																		
avg.		92	0	142	350	1862	2446	_	_	-	_	_	_	_	_	_		-	_
10−y avg <sup>b</sup>		189	0	295	697	4544	5725	_		_	_	_	_	_	_	_	_	_	_

<sup>&</sup>lt;sup>1</sup> 1988-1992 <sup>b</sup> 1983-1992

<sup>&</sup>lt;sup>c</sup> Subsistence survey not conducted. <sup>d</sup> No commercial harvest reported.

SHAKTOOLIK (SUBDISTRICT 5)

			C	ommercia	1				:	Subsistenc	е					Combined			
	Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook S	ockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
	1961	140	_	_	29075	24746	53961	_	_	_	_	_	_	140	_	_	29075	24746	53961
	1962	1738	_	2113	640	8718	13209	_	-	_	_	_	_	1738	_	2113	640	8718	13209
	1963	480	11	563	5138	19153	25345		-	-		_		480	11	563	5138	19153	25345
	1964	631	79	16	1969	35272	37967	77	-	340	2132	5412	7961	708	79	356	4101	40684	45928
	1965	127	30		3	8356	8516	31		107	3763	3420	7321	158	30	107	3766	11776	15837
	1966	310	_	956	344	8292	9902	142	_	762	1445	4183	6532	452	-	1718	1789	12475	16434
	1967	43	-	88	1050	1655	2836	262	-	387	2010	4436	7095	305		475	3060	6091	9931
	1968	61	_	130	2205	2504	4900	10	-	458	6355	1915	8738	71		588	8560	4419	13638
	1969	33	_	276	6197	8645	15151	40	_	193	4018	3439	7690	73		469	10215	12084	22841
	1970	197	_	155	2301	15753	18406	43	_	210	2474	2016	4743	240	_	365	4775	17769	23149
	1971	284	_	238	28	13399	13949	87	. –	329	494	5060	5970	371	_	567	522	18459	19919
	1972	419	_	11	2798	12022	15250	64	_	235	939	3399	4637	483	_	246	3737	15421	19887
	1973	289	_	177	6450	14500	21416	51	_	130	3410	1397	4988	340	_	307	9860	15897	26404
	1974	583	_	179	5650	26391	32803	93	-	353	1901	358	2705	676	_	532	7551	26749	35508
	1975	651	2	812	1774	49536	52775	18	_	14	1394	334	1760	669	2	826	3168	49870	54535
	1976	892	_	129	15803	15798	32622	24	-	121	1188	269	1602	916		250	16991	16067	34224
	1977	1521	4	418	7743	36591	46277	49	_	170	585	2190	2994	1570	4 7	588	8328	38781 36558	49271 88627
	1978	1339	7	1116	46236	35388	84086	81	-	15	3275	1170	4541	1420	-	1131	49511		
	1979	2377	_	3383	18944	22030	46734	62	-	1605	2575	1670	5912	2439	_	4988	21519	23700	52646
	1980	1086	_	8001	1947	27453	38487	57	_	756	3227	1827	5867	1143	_	8757	5174	29280	44354
34	1981	1484	4	1191	29695	21097	53471	8	-	525	2225	3490	6248	1492	4	1716	31920	24587	59719
12	1982	1677	3	22233	17019	26240	67172	68	-	2138	3865	1165	7236	1745	3	24371	20884	27405	74408
	1983	2742	4	12877	12031	67310	94964	-	-	_	_						-		-
	1984	1613	-	10730	1596	32309	46248	_	-	_	<del>-</del>			°			_		
	1985	5312	_	2808	_	13403	21523	298	-	1379	24	298	1999	5610		4187	24	13701	23522
	1986	1075	29	6626	-	16126	23856	_	_	-			-				-	_	_
	1987	2214	-	6193	-	14088	22495	-	_	-	_	-	_			_	_		
	1988	671	79	6096	3681	21521	32048		-	_	-	_	_				_	-	_
	1989	1241	43	8066		19641	28991	_	_	-	_	-			_	_	_	_	_
	1990	2644	49	4695	_	21748	29136	-	-	_	_	-	-			-	-	_	_
	1991	1324	55	11614	-	31619	44612	-	-	_			_			_	_	_	
	1992	1098	56	14660	_	27867	43681	_	_	_	-	_	-	-9		_	-	-	-
	1993	2756	20	11130	106743	20864	141513							<u> </u>					
5-yea																			
avg. •		1396	56	9026	736	24479	35694	-		_	_		-	_	_	-	_		_
10-ye	ear																		
avg <sup>6</sup>		1993	32	8437	1731	26563	38755	-		_	_	-	, <del>-</del>	-	_	-	_	-	

<sup>&</sup>lt;sup>1</sup> 1988-1992 <sup>b</sup> 1983-1992

<sup>&</sup>lt;sup>c</sup> Subsistence survey not conducted.

UNALAKLEET (SUBDISTRICT 6)

			C	Commercia	I				5	Subsistenc	e					Combined			
	Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook S	ockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
	1961	5160	35	13807	5162	23586	47750	_	_	_	_	-	•••	5160	35	13807	5162	23586	47750
	1962	5089	_	6739	6769	30283	48880	_	-		_	_	_	5089	-	6739	6769	30283	48880
	1963	5941	18	16202	1140	27003	50304	-		_	_	_	_	5941	18	16202	1140	27003	50304
	1964	1273	1	79	1	19611	20965	488	-	2227	7030	6726	16471	1761	1	2306	7031	26337	37436
	1965	1321	_	2030	24	26498	29873	521	_	4562	11488	8791	25362°	1842	_	6592	11512	35289	55235
	1966	1208		4183	5023	16840	27254	90	-	789	6083	3387	10349 °	1298	_	4972	11106	20227	37603
	1967	1751	_	1544	21961	8502	33758	490	_	484	9964		10938 °	2241	-	2028	31925	8502	44696
	1968	960	-	6549	41474	14865	63848	186	-	1493	11044	2982	15705 °	1146	_	8042	52518	17847	79553
	1969	2276	_	5273	40558	22032	70139	324	<b>.</b>	1483	4230	4196	10233 °	2600	-	6756	44788	26228	80372
	1970	1604	_	4261	30779	40029	76673	495	-	3907	10104	7214	21720°	2099	_	8168	40883	47243	98393
	1971	2166	_	2688	1196	37543	43593	911	_	3137	2230	7073	13351 °	3077	_	5825	3426	44616	56944
	1972	2235	_	412	28231	20440	51318	643	_	1818	3132	4132	9725	2878	_	2230	31363	24572	61043
	1973	1397	_	8922	13335	25716	49370	323	<del>-</del>	213	6233	3426	10195	1720	•••	9135	19568	29142	59565
	1974	2100	_	1778	93332	36170	133380	313	_	706	7341	588	8948	2413	_	2484	100673	36758	142328
	1975	1638	-	3167	12137	48740	65682	163	_	74	4758	2038	7033	1801		3241	16895	50778	72715
	1976	1211	1	5141	37203	24268	67824	142	-	694	4316	2832	7984	1353	1	5835	41519	27100	75808
	1977	2691	1	2781	21001	32936	59410	723	-	1557	8870	6085	17235	3414	1	4338	29871	39021	76645
	1978	7525	5	5737	136200	37079	186546	1044	_	2538	13268	3442	20292	8569	5	8275	149468	40521	206838
	1979	6354	8	23696	49647	30445	110150	640	_	3330	6960	1597	12527	6994	8	27026	56607	32042	122677
	1980	4339	3	21512	203142	64198	293194	1046		4758	19071	5230	30105	5385	3	26270	222213	69428	323299
ဌာ	1981	6157	47	29845	123233	39186	198468	869	24	5808	5750	4235	16686	7026	71	35653	128983	43421	215154
01	1982	3768	2	61343	142856	44520	252489	913	2	7037	20045	4694	32691	4681	4	68380	162901	49214	285180
	1983	7022	13	36098	26198	109220	178551	1868	33	6888	13808	4401	26998	8890	46	42986	40006	113621	205549
	1984	6804	6	47904	_	43317	98031	1650	1	6675	17418	3348	29092	8454	7	54579	17418	46665	127123
	1985	12621	21	15421	1	25111	53175	1397	3	2244	55	1968	5667 d	14018	24	17665	56	27079	58842
	1986	4494	153	20580	_	30239	55466	_	_	-	_	_		-	_	-	-		_
	1987	3246	141	15097	97	17525	36106	_	-			_	_ d	_	_	_	_		-
	1988	2218	157	24232	23730	25363	75700	_		-	·		_ d	_	-	_		$\overline{\cdot}$	-
	1989	4402	222	36025	-	20825	61474	_		4681	17500	1388	_ e	_	_	_		_	_
	1990	5998	358	52015	-	23659	82030	2476 °	-	****	-	-	-	_	_			-	-
	1991	4534	147	52033		39609	96323	<u> </u>	-	_	_	-	_ d	-	-	-	-	_	-
	1992	3409	229	84449	6284	52547	146918	-	-	_	_		d	_	_	-		-	_
	1993	5944	251	26290	42061	28156	102702	<del>-</del>										_	
5-y€																			
avg.	•	4112	223	49751	6003	32401	92489	_	_	_	_	-	_	_	_	_	-		-
10-չ																			
avg <sup>b</sup>		5475	145	38385	5631	38742	88377		-	_	_	_	-	_	_	_	-	_	_

<sup>&</sup>lt;sup>a</sup> 1988-1992 <sup>b</sup> 1983-1992

<sup>&</sup>lt;sup>c</sup> Subsistence catches from 1966-72 includes fish taken at St. Michael.

<sup>&</sup>lt;sup>d</sup> Subsistence surveys not conducted.

<sup>&</sup>lt;sup>c</sup> In-depth survey by Subsitence Division.

ALL SUBDISTRICTS

								T											
			C	Commercia	J				:	Subsistend	e					Combined			
	Year	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
	1961	5300	35	13807	34327	48332	101801	_	_	_	-	_		5300	35	13807	34327	48332	101801
	1962	7286	18	9156	33187	182784	232431	-	_	_	_	_	-	7286	18	9156	33187	182784	232431
	1963	6613	71	16765	55625	154789	233863	5	_	118	16607	17635	34365	6618	71	16883	72232	172424	268228
	1964	2018	126	98	13567	148862	164671	565		2567	9225	12486	24843	2583	126	2665	22792	161348	189514
	1965	1449	30	2030	220	36795	40524	574	_	4812	19131	30772	55289	2023	30	6842	19351	67567	95813
	1966	1553	14	5755	12778	80245	100345	269	_	2210	14335	21873	38687	1822	-14	7965	27113	102118	139032
	1967	1804	_	2379	28879	41756	74818	817	_	1222	17516	22724	42279	2621		3601	46395	64480	117097
	1968	1045		6885	71179	45300	124409	237	_	2391	36912	11661	51201	1282	_	9276	108091	56961	175610
	1969	2392	_	6836	86949	82795	178972	436	-	2191	18562	15615	36804	2828	_	9027	105511	98410	215776
	1970	. 1853	-	4423	64908	107034	178218	561	_	4675	26127	22763	54126	2414	_	9098	91035	129797	232344
	1971	2593	_	3127	4895	131362	141977	1026	197	4097	10863	21618	37801	3619	197	7224	15758	152980	179778
	1972	2938	_	454	45182	100920	149494	804	93	2319	14158	13873	31247	3742	_	2773	59340	114793	180741
	1973	1918	_	9282	46499	119098	176797	392	_	520	14770	7185	22867	2310	_	9802	61269	126283	199664
	1974	2951	_	2092	148519	162267	315829	420	_	1064	16426	3958	21868	3371	_	3156	164945	166225	337697
	1975	2393	2	4593	32388	212485	251861	186	11	192	15803	8113	24305	2579	13	4785	48191	220598	276166
	1976	2243	11	6934	87919	95956	193063	203	-	1004	18048	7718	26973	2446	11	7938	105967	103674	220036
	1977	4500	5	3690	48675	200455	257325	846	_	2530	14296	26607	44279	5346	5	6220	62971	227062	301604
	1978	9819	12	7335	325503	189279	531948	1211	-	2981	35281	12257	51730	11030	12	10316	360784	201536	583678
	1979	10706	57	31438	167411	140789	350401	747	-	8487	25247	11975	46456	11453	57	39925	192658	152764	396857
	1980	6311	40	29842	227352	180792	444337	1397	_	8625	63778	19622	93422	7708	40	38467	291130	200414	537759
ယ္က	1981	7929	56	31562	232479	169708	441734	2021	38	13416	28741	32866	77082 °	9950	94	44978	261220	202574	518816
σ	1982	5892	10	91690	230281	183335	511208	1011	8	14612	54249	18580	88460 ° _ d	6903	18	106302	284530	201915	599668
	1983	10308	27	49735	76913	319437	456420	-	-	_	_	_	_ d	_	_	_	_	_	_
	1984	8455	6	67875	119381	146442	342159	) -	_	-	_	_	_ d	_	_	_	_	_	_
	1985	19491	166	21968	3647	134928	180200	-	_		_	_	_ d	_		_		_	_
	1986	6395	233	35600	41260	146912	230400	-	_	-		-	_ d	_	_	_	_	_	
	1987	7080	207	24279	2260	102457	136283	-				_	_ d			_	_	_	_
	1988 1989	4096 5707	1252 265	37214 44091	74604 123	107966 42625	225132 92811	_	_	_	_	_	_ d	-	<del>-</del>	_	_	_	-
	1990	8895	434	56712	501	65123	131665	_	_	_	_	_	d	_	_	_	_	_	_
	1990	6068	203	63647	301	86871	156789	1 =	_	•••		_	_ d	_		_	_	_	_
	1992	4541	203	105418	6284	83394	199933	1 _	_		_	_	_ d				_	_	_
	1993	8972	279	43283	157574	53562	263670	] _	_	_	_	_	_ d	_		_	_	_	_
		0972	219	43203	15/5/4		203070	<del>                                     </del>											
5-ye avg.		5861	490	61416	16302	77196	161266	_	_	_	_	_	_	_	_	_	_	_	
_		5501	.55	2,															
10-y avg <sup>b</sup>		8104	309	50654	32497	123616	215179	_	-	-	-	_	-	_	_	-	-	-	-

¹ 1988-1992

<sup>&</sup>lt;sup>b</sup> 1983-1992

 $<sup>^{\</sup>rm c}$  These figures also include data from Stebbins and St. Michael.  $^{\rm d}$  Subsistence surveys not conducted.

Appendix Table A9. Mean salmon weights, Norton Sound District, 1962-1993.

Year	Me Chinook	an Round Weight Coho	in Pounds <sup>b</sup> Pink	Chum
1962	-	-	-	
1963	-	-	-	-
1964	-	-	-	7.0
1965	_	-	2.3	7.1
1966	-	-	3.5	7.8
1967	23.7	7.0	3.6	7.2
1968	20.0	7.0	4.0	7.5
1969	19.3	7.5	3.6	6.4
1970	20.0	7.0	3.5	7.8
1971	23.7	7.0	3.6	7.2
1972	20.0	7.3	2.8	6.9
1973	20.3	6.8	3.9	7.1
1974	18.2	6.7	3.4	6.6
1975	10.8	7.4	2.9 3.1	6.5
1976	15.2	7.2	3.1	7.0
1977	22.7	7.6	3.3	7.0
1978	22.8	6.9	3.6	7.4
1979	22.9 21.5	7.1	3.6	7.2 7.2
1980	20.7	6.8 6.7	3.2 3.5	7.6
1981 1982	16.5	7.1	2.9	7.8
1982	17.4	7.1	3.6	7.3
1984	20.0	7.7	2.9	7.4
1985	21.5	7.7	3.1	7.0
1986	20.8	6.9	3.2	6.9
1987	20.0	7.3	3.0	7.1
1988	16.4	7.5	3.0	7.1
1989	18.4	7.6	3.6	7.0
1990	19.0	7.5	-	7.4
1991	17.7	7.4	_	6.9
1992	12.7°	7.8	2.9	7.1
1993	16.9	6.6	2.6	6.5

<sup>&</sup>lt;sup>a</sup> Information not available for some species.
<sup>b</sup> Based on age-weight-length samples or fish tickets.
<sup>c</sup> Low chinook weight due to restricted mesh size.

Appendix Table A10. Estimated mean prices paid to commercial salmon fishermen, Norton Sound District, 1962-1993.a

Year	Chinook	Coho	Pink	Chum
		Price Per	Fish	
1962 1963 1964 1965 1966	\$3.85 3.85 4.50 3.75 4.80	\$ .60 .60  .45 1.05	\$ .25 .25 .25  .25	\$ .35 .35 .40 .40 .65
		Price Per	Pound	
1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 <sup>c</sup> 1992 <sup>d</sup>	.20 .25 .22 .25 .27 .40 .40 .50 .65 .65 .88 .74 \$1.25 \$1.25 \$1.13 \$1.20 \$1.08 .88 \$1.11 \$1.26 .73	.14 .14 .14 .14 .16 .16 .16 .16 .32 .40 .35 .66 .63 .62 .57 .39 .45 .48 .52 .57 \$1.13 .43 .50 .36	.07 .06 .06 .07 .06 .07 .13 .13 .17 .16 .20 .16 .07 .13 .12 .11 .11 .20 .15 .20	.09 .10 .11 .10 .11 .32 .32 .24 .30 .30 .30 .41 .23 .26 .32 .28 .24 .31 .27 .33 .39 .18 .23 .27 .22

 $<sup>^{\</sup>rm a}$  Information is not available for some species.

Price paid for coho and chum roe was \$3.00 per pound.

Price paid for coho roe was \$1.50 per pound.

Price paid for coho roe was \$1.76 per pound and \$0.40.

e Price paid for coho roe was \$1.76 per pound and \$0.40 per pound for sockeye.

Appendix Table All. Dollar estimates of Norton Sound District commercial salmon fishery, 1961-1993.

	Gross Value		License and Tax
V	of Catch to	– .b	Revenues to State
Year	Fishermen	Wages Earned <sup>b</sup>	(License Fees Only)
1961	\$ a	<b>\$</b> . a	\$ 2,010.00
1962	105,800.00	a	16,341.00
1963	104,000.00	a	18,009.00
1964	51,000.00	a	11,305.00
1965	21,483.00	a	5,084.00
1966	68,000.00	a	4,680.00
1967	44,038.00	58,000.00	3,500.00
1968	63,700.00	´ a	4,000.00
1969	95,297.00	72,145.00	a
1970	99,019.00	55,100.00	5,595.00
1971	101,000.00	65,500.00	5,730.00
1972	102,225.00	68,700.00	7,000.00
1973	308,740.00	81,000.00	15,400.00
1974	437,127.00	129,600.00	20,028.00
1975	413,255.00	172,800.00	28,230.00
1976	285,283.00	a	10,133.00
1977	528,610.00	a	11,386.00
1978	814,221.00	a	12,002.00
1979	876,547.00	a	11,780.00
1980	583,388.00	a	11,640.00°
1981	758,471.00	<b>a</b>	11.940.00
1982	988,588.00	a	7,155.00° d
1983	1,038,967.00	a	10,700.00°
1984	721,055.00	a	9,690.00°
1985	822,056.00	a ,	5,820.00 <sup>e</sup>
1986	539,576.00	a	5,970.00 <sup>e</sup>
1987	504,631.00	a	5.940.00 <sup>e</sup>
1988	754,751.00	a	10,050.00 <sup>e</sup> f
1989	335,928.00	a	10,300.00 <sup>e</sup>
1990	497,623.00	a	10,350.00 <sup>e</sup>
1991	425,430.00	a	10,250.00 <sup>e</sup>
1992	448,395.00	a	10,200.00 <sup>e</sup>
1993	322,117.00	a	8,835.99 <sup>e</sup>

<sup>&</sup>lt;sup>a</sup> Information not available.

b Includes wages paid to tender boat operators, processing

plant employees in district.

C Includes only permit renewals and vessel license fees. The Alaska state legislature lowered all resident permit renewal fees and vessel license fees to poverty level fees for 1982.

e Includes only permit renewal fees.
f The Alaska state legislature raised resident permit renewal fee to \$50.00 in 1988.

Appendix Table Al2. Round weight of commercially caught salmon by species, Norton Sound District, 1961-1993.

	Pound	ds Caught	(Round Wt. in	Lbs)	C = 1
Year	Chinook	Coho	Pink	Chum	Salmon Roe (lbs)
1961	120,405	96,649	102,711	347,990	
1962ª	157,000		10,569	221,645	
1963 <sup>a</sup>	89,700	51,750			
1964 <sup>a</sup>	39,169	686		249,890	L
1965	33,327	14,210	660	264,924	b
1966	35,259	40,285	38,334	577,764	16,901
1967	41,854	15,944	100,913	289,473	21,429
1968 <sup>c</sup>	22,954	50,665	250,044	306,871	20,381
1969 <sup>d</sup>	51,441	50,461	312,836	529,235	5,578
1970	38,103	25,000	156,313	610,588	1,345
1971	43,112	22,078	15,377	857,014	1,122
1972	57,675	3,257	133,389	710,853	1,083
1973	38,935	63,812	185,799	845,596	D
1974	54,433	15,023	511,737	1,082,575	39,876
1975	25,964	32,345	87,586	1,318,111	46,470
1976	34,095	49,822	271,867	669,728	_
1977	102,341	28,254	162,457	1,415,981	b b
1978	222,974	50,872	1,164,174	1,389,806	
1979	231,988	251,129	598,785	1,001,548	b b
1980	135,646	204,498	719,368	1,301,693	b
1981	164,182	212,065	719,102	1,284,193	
1982	97,255	648,212	659,171	1,338,788	95
1983	179,666	360,264	274,568	2,352,104	239
1984	169,104	523,310	343,685	1,020,635	0
1985	419,331	169,413	11,458	939,885	0
1986	133,161	247,333	133,319	1,011,824	0
1987	141,494	177,569	6,691	731,597	0
1988	67,148	280,658	226,966	767,168	0
1989	104,829	336,652	439	297,156	0
1990	168,745	426,902		482,060	75
1991	107,541	469,495		597,272	221
1992	57,571	820,406	18,230	595,345	2,641
1993	151,504	287,702	406,820	347,072	2,608

<sup>&</sup>lt;sup>a</sup> Does not include canned salmon cases (48#)

1962: 29 chinook, 883 coho, 927 pink, 12,459 chum

<sup>1963: 604</sup> chinook, 808 coho, 1,918 pink, 13,308 chum 1964: 75 chinook, 452 pink, 9,357 chum Information not available

Includes about 48,000 lbs of salted coho, about 150,000 lbs. of salted pink, and 150,000 lbs of salted chum.

Includes about 598 lbs. of salted chinook, about 48,092 lbs. of salted pink and about 117,664 lbs. salted chum.

				Pink &	
Year	Chinook	Chum	Pink	Chum b	Coho
			uk River		
1975	-	4,662	5,390	_	_
1977	-	5,207	1,302	-	_
1978		8,756	22,435	_	_
1980	3	2,022	199,000	-	1,002
1981	-	5,579	350	-	_
1982	-	638	148,800	-	_
1983	48	2,150	10,770	-	96
1984	7 h	493 <sup>h</sup>	284,400 b	-	192
1985	4	1,910	8,860		33
1986	4	1,960	28,690		_
1987	5	4,540	30	_	230
1988	3	2,070	4,652 <sup>1</sup>	_	563
1989	_	1,025	26,850	-	75
1990	٠ ـــ	95	29,040	_	161
1991	3	5,420	14,680	_	701
1992	_	470	292,400	<del>-</del>	422
1993	7	1,570	5,120	_	104
,000	,	1,070	5,125		
		No	me River		
1971	-	75	7,765	-	-
1972	_	710	14,960	_	_
1973	6	1,760	14,940	· -	-
1974	_	854	17,832	-	_
1975	1	2,161	3,405	_	_
1977	5	3,046	1,726		_
1978	2	5,242	34,900	_	_
1980	5	_	- · · · -	179,095	920
1981	15	1,195°	12,565	_	_
1982	-	700	327,570	_	_
1983	2	198	9,170		365
1984	-	2,084 h	178,870	_	839
1985	7	1,967	2,250	_	242
	2				242
1986		1,150	13,580	-	
1987	3	1,646	1,400 h	_	419
1988	3	973	2,490 1	-	1,280 h
1989	2	72	1,365	-	375
1990	_	541	13,085	_	617
1991	9	3,520	4,690	-	611
1992	3	813	255,700	_	691
1993	56 <sup>d</sup>	1,520	9,212 <sup>d</sup>	-	3,061 <sup>d</sup>
		Fla	mbeau River		
1976	_	375	1,994	_	_
1977	_	1,275	10	_	_
	_		10	_	_
1978	_	7,110	001	-	_
1979	_	283	291	-	_
1980		-	- 740	29,190	_
1981	1	12,031	2,710	. –	_
1982	1	5,097	25,001	-	-
1983	2	1,195	200	_	_
1984	1	3,150 <sup>g</sup>	20,200 <sup>g</sup>	_	-
1985	1	3,215	260	-	-
1986	2	3,075	300	-	_
1987	0	115	0	-	-
1988	3	765	10	-	-
1989	_	_	_	_	_
	-	_	_	_	_
1990					
1990 1991	2	1.564	570	_	_
1990 1991 1992	2	1,564 606	570 180	<del>-</del> -	_

Year	Chinook	Chum	Pink	Pink & Chum <sup>b</sup>	Coho
		e i	dorado River		
1974	13	2,143	6,185	_	_
1977	-		125	-	
1978	_	1,835	12,800	_	_
1980	6	10,125 9,900	55,520	_	_
1981	-			_	
1982	2	15,605	495	_	_
		1,095	163,300	-	100
1983 1984	11 14 <sup>i</sup>	994 4,361 <sup>g i</sup>	270	-	100
			1,924,935 <sup>g i</sup>	_	261
1985	8	6,090	150	_	67
1986	9	3,490	18,200	_	- 100
1987	6	3,860	0	_	108
1988	17	2,645	1,045	-	78
1989		350	1,550	. <del>-</del>	87
1990	17	884	2,050	-	44
1991	76	5,755	1,590	-	98
1992	-	4,887	6,615	-	113
1993	38	2,885	120	_	110
		Fis	sh River		
1961	1	_	_	14,100	-
1962	48	_	-	28,918	-
1963	21	-	-	25,728	-
1964	-	18,670	10,935	14,550	-
1966	7	-	_	17,955	_
1967	20	-	_	13,610	-
1968	10	· –	-	164,000	_
1969	_	2,080	124,000	_	_
1970	33	76,550	198,000	_	_
1971	1	13,185	1,670	_	_
1972 b	<u>-</u>	3,616	13,050	_	-
1973	31	6,887	15,564	_	_
1974	7	10,945	15,690	_	_
1975	26	20,114	15,840	_	_
1976	1	8,390	15,850	8,550	_
	9			6,550	_
1977	29	9,664	2,430	_	_
1978		26,797	140,640	_	_
1979	11	6,893	9,132	_	_
1980		19,100	33,500	_	_
1981	90	24,095	450	-	_
1982	-		-	241,700	-
1983	87	20,037	300		-
1984	42	<del>.</del>		293,245	_
1985	303	21,080	7,365	,-	_
1986	200	25,190	140	-	_
1987	193	7,886	0	-	-
1988	36	1,240	29,950 <sup>1</sup>	-	-
1989					
1990					
1991	58	10,190	51,190	-	_
1992	4	390	1,387,000	-	-
1993	48	12,695	13,440	-	-
		Ka	achavik Creek		
1963	_	16,000	16,000	_	-
1964	-	5,284	3,675	_	_
1966	_	758	1,788	_	-
1967 °	<del>-</del>	-		1,780	
1969	_	600	4,525	-,,,,,,	
1970	_	500	7,020	_	_
	-		E 302	<del>.</del>	_
1971	-	1,000	5,323	_	-
1972	-	3,100	16,950	-	-
1973	-	10,325	22,275	-	-
1974	-	1,645	2,723	-	-
1975	_	1,735	23,360	_	-
1977 <sup>d</sup>	-	9,564	30,432	_	-
	_	3,481	26,533	_	_
1978 <sup>d</sup>	_				
	_	2,650 1,111	23,850 72,235	_	-

<sup>-</sup>Continued -

Year	Chinook	Chum	Pink	Pink & Chum <sup>b</sup>	Coho
		Ros	ston Creek		
1963	67	1,669	_	_	_
1964	10	3,315	_		
			_	_	_
1966 °	153	761		_	_
1968	7	2,500	2,500		_
1969	100	7,000	16,000	-	<del>-</del> .
1970	246	8,200	12,900	_	~
1971	42	7,045	80	_	-
1972	57	4,252	3,950	_	_
1973	153	3,014	3,213	_	-
1974	231	2,426	749	_	_
1975	147	1,885	2,556	_	_
1977	76	1,325	385	_	
				_	_
1978	136	2,655	74,221	_	_
1979	58	882	271	-	_
1980	16	2,450	1,510		_
1982	10	1,730	22,020	-	_
1983	154	704	_	_	_
1984	35	_	_	47,850	-
1985	243	3,450	_	,	_
1986	2	220	0	_	_
1987	583	3,640	ő	_	_
			7,400 <sup>1</sup>	_	
1988	163	1,040	7,400	_	_
1989	-		_	_	-
1990	_	1,455	8,440	-	_
1991	152	2,550	3,210	-	-
1992	68	1,540	803,200	_	_
1993	227	4,513	1,930	. <b>–</b>	_
		Niu	kluk River		
1962	11	_	-	27,879	_
		10 607	4 400	21,013	
1963	1	13,687	4,103	•••	_
1964		8,395	10,495		_
1966	_	21,300	8,600	4,700	-
1967	-	20,546	-	_	_
1968	-	_	_	87,085	_
1969	-	10,240	92,650	_	-
1970	_	7,300	60,350	-	_
1971	_	22,605	8,370	_	_
1972 °	_	10,500	22,600	_	_
1973		14,365	14,790	_	_
	_				
1974	1	8,720	8,915	_	_
1975	-	10,089	16,258		_
1976	_	4,130	7,190	-	
1977	19	10,456	4,150	-	_
1978	2	14,365	208,300		
1979 <sup>d</sup>	8	10,127	30,147	_	_
1980	_	8,915	75,770	_	_
1981	_	7,249	70,770	_	_
	00		007.540		
1982	20	2,557	227,540	_	_
1983 ု	54	8,886	50	_	_
1984 <sup>j</sup>	6	_	-	57,208	3,072
1985	25	11,140	-	-	332 k
1986	2	2,442	0	<u> </u>	-
1987	10	4,145	Ō	_	257 k
1988	18	6,501	8,160 <sup>1</sup>	_	1,095 k
	10	0,507	0,100		182
1989	_	-	-	_	
1990	_	6,200	-	_	170
1991	24	10,660	37,410	_	1,783
1992	_ 15	7,770	803,200	_	812
1993			2,840		2,104

Year	Chinook	Chum	Pink	Pink & Chum <sup>b</sup>	Coho
1962	3	. Kv	viniuk River _	23,249	_
1963	2	11,340	3,779	23,249	_
1964			3,779	_	_
1964 1965 <sup>d</sup>	-	14,533		-	_
	14	26,634	8,301	-	_
1966 <sup>d</sup>	7	32,786	10,629	-	_
1967 <sup>d</sup>	13	24,444	3,508	_	_
1968 <sup>d</sup>	27	18,813	126,764	-	_
1969 <sup>d</sup>	12	19,687	56,683	_	-
1970 <sup>d</sup>	-	68,004	235,131	-	_
1971 <sup>d</sup>	37	39,046	16,742	-	-
1972 <sup>d</sup>	65	30,686	62,461	-	-
1973 <sup>d</sup>	57	28,617	38,420	-	
1974 <sup>d</sup>	62	35,899	40,816	_	_
1975 <sup>d</sup>	44	14,344	57,317	_	_
1976 <sup>d</sup>	12	6,977	29,471	_	-
1977 <sup>d</sup>	84	22,757	46,234	_ '	_
1978 <sup>c d</sup>	74	14,408	72,270	_	_
1979 <sup>d</sup>	107	12,355	167,492	_	
1980 <sup>d</sup>	177	19,374	320,389		_
1981 <sup>d</sup>	136				
		34,561	566,417	<del>-</del>	_
1982 <sup>d</sup>	138	44,036	469,674	-	_
1983 <sup>d</sup>	267	56,907	251,965	_	
1984 <sup>d</sup>	736	54,043	736,544	-	983
1985 <sup>đ</sup>	712	9,912	22,548	_	673
1986 <sup>d</sup>	653	24,704	241,446	-	421
1987 <sup>d</sup>	314	16,134	5,567	-	819 <sup>1</sup>
1988 <sup>d</sup>	321	13,301	187,904	-	444 1
1989 <sup>đ</sup>	282	13,689	30,275	_	_ '
1990 <sup>d</sup>	744	13,735	404,452	_	746
1991 <sup>d</sup>	587	18,802	54,591	_	809
1992 <sup>d</sup>	479	12,077	1,464,717	_	532
1993 <sup>d</sup>	565	15,823	43,065	-	1,238
		Tu	butulik River		
1962	3	-	_	16,690	_
1963	9	16,069	4,355	_	_
1964	_	15,469	10,043	3,420	_
1966	-	5,514	26,000		_
1967	1	_	_	22,475	_
1969	3	12,040	12,788	3,045	_
1970		53,290	136,590		_
1971	_	16,820	7,500	5,065	_
1972 °	_	8,070	21,100	-	_
1973	131	5,383	15,665	_	_
				_	-
1974	136	9,560	17,940	. –	
1975	7	17,141	38,003	-	-
1976	_	1,095	6,095	2,600	_
1977	-	8,540	4,685	-	_
1978	2	5,865	1,364	-	-
1979		812	1,624	_	
1980°	405	21,616	663,937	<del>-</del>	_
1982 °	49	2,044	53,605	_	-
1983	135	16,345	40,790		_
1984	139	56,210	93,600	-	_
1985	472	13,645	8,940	_	_
1986	453	5,975	35,680	_	
1987	453 474		580	<del>-</del>	_
		9,605 4,660		-	_
1988	561	4,660	114,450 <sup>1</sup>		_
1989°	-		-	_	_
1990	397	4,350	186,400	_	_
1991	661	7,085	26,870	-	-
1992	260	2,595	138,600	-	-
1993					1,395

				Pink &	
Year	Chinook	Chum	Pink	Chum <sup>b</sup>	Coho
		No	rth River		
1962	162	<u> </u>	_	16,087	_
1963 °	287	_		73,274	<del></del> .
1964	23	-	-	5,981	_
1965	153	<u> </u>		16,600	- <del>-</del>
1970 <sup>c</sup>	1	20,655	12,400	_	_
1971 °	256	_	_	1,047	_
1972 <sup>đ</sup>	561	2,332	54,934	<del>-</del>	_
1973 <sup>d</sup>	298	4,332	26,542	_	_
1974 <sup>d</sup>	220	861	154,285	***	_
1975 <sup>c</sup>	60	5,237	17,885	_	_
1976 °	66	196	10,606	_	_
1977	1,275	8,139	4,565	-	_
1978	321	9,349	21,813	_	
1979	735	1,130	9,500	_	
1980	61	2,300	127,900	_	204
1981	68	405	575	_	263
1982	8	599	173,352	_	4,145
1983	347	4,135	4,980	_	_
1984 <sup>d</sup>	2,844	2,915	458,387	_	152 <sup>f</sup>
1985 <sup>d</sup>	1,426	4,567	4,360		2,045
1986 <sup>d</sup>	1,613	3,738	236,487	_	· _
1987	445	392	0		680
1988	202	30	112,770 <sup>1</sup>	-	240
1989 °	_	_	_	_	_
1990	255	510	25,685	_	_
1991	656	2,435	118,720	<del>-</del>	2,510
1992	329	_	631,140	_	398
1993	900	445	13,570	_	1,397

<sup>a Represents "high count" for season.
b Surveyor unable to distinguish between the two species.
c Poor survey conditions or partial survey, poor counting tower conditions.
d Total counts obtained from counting tower.
e Combined tower and aerial survey counts below the tower.</sup> 

f Aerial survey; not tower count.

g Helicopter survey.

h Boat survey.

i Foot survey.

j Includes counts from Casadepaga and Ophir Creeks.

k Includes counts from Ophir Creek.

Numerous pink salmon made enumerating of chum salmon difficult; pink count may include some chum.

### PORT CLARENCE DISTRICT

#### District Boundaries

The Port Clarence district encompasses all waters from Cape Douglas north to Cape Prince of Wales including the Salmon Lake and Pilgrim River drainage (Figure 2). Salmon, saffron cod, whitefish and herring are the major subsistence species; however, other fishery resources are also utilized.

## Commercial Fishery

Commercial salmon fishing in this district has been prohibited since 1967. In 1966 a total of 1,216 salmon consisting of 93 sockeye, 131 pinks and 922 chums was taken commercially in the Grantley Harbor/Tuksuk Channel area. A few salmon are sold or bartered each year in Teller and Nome. Due to the relatively small runs in this area and the existence of an important subsistence fishery, commercial salmon fishing has not been reopened.

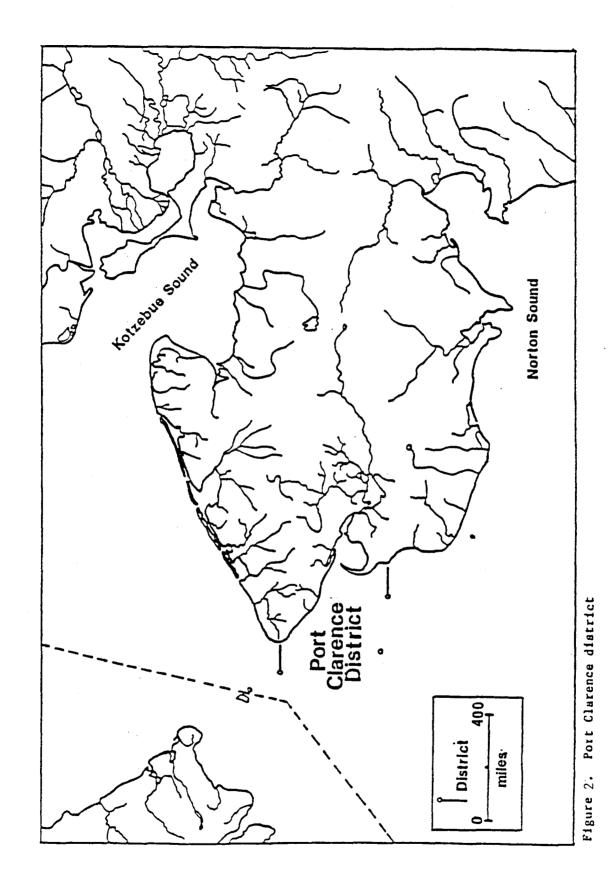
## Subsistence Fishery

A traditional subsistence salmon fishery has probably occurred within this district for centuries; however, subsistence fishing has only been reported or monitored at Salmon Lake since the 1930's and upper Pilgrim River since 1962. Data collected by Department personnel has indicated a majority of the fishermen of Brevig Mission fish the northern and northeastern sections of Port Clarence, while Teller fishermen utilize Grantley Harbor and Tuksuk Channel. Interviews with local residents have also indicated substantial fishing effort within the Agiapuk River. Village surveys have not been conducted by Commercial Fisheries Division since 1983. Subsistence Division conducted a partial survey of Brevig Mission in 1989 where 15 of 43 households were interviewed (Appendix Table B1). Personal interviews with fishermen seem to indicate a decline in subsistence fishing effort, due primarily to the absence of younger fishermen entering the fishery. A majority of the subsistence fishing effort appears to be conducted by elder residents who gather fish for an entire family.

Salmon Lake and Pilgrim River stocks have been utilized primarily by Nome residents. The Alaska Board of Fisheries adopted a regulation in 1972 which closed Salmon Lake and it's tributaries to subsistence salmon fishing from July 15 through August 31 to conserve declining sockeye salmon stocks. Subsistence fishing permits are required for the Pilgrim and Kuzitrin Rivers. Beginning in the 1991 season, a dramatic increase in the number of subsistence permits issued to Nome residents intending to fish in the area was observed (Table 2). This was due in part due to a strong sockeye salmon return. Another reason was the extensive subsistence fishing closures in the Nome area which made the Pilgrim River an alternative location to obtain their subsistence needs.

# Escapement

Aerial surveys were not flown in this district, with the exception of Salmon Lake, due to the low priority assigned to districts which do not support commercial fisheries. Aerial surveys show an increasing trend of sockeye returns to Salmon Lake since 1986 (Appendix Table B2). The 1993 aerial survey count of 3,092 red salmon is the third highest on record since 1963. Recent year counts are in the upper end of the range and reflect an increasing populations.



	Number of Fishing Families						
 Year	Interviewed	Chinook	Sockeye	Coho	Pink	Chum	Total
1963	19	9	4866	25	1061	1279	7240
1964	22	17	1475	227	371	1049	3139
1965	29	36	1804	639	1854	1602	5935
1966	26	10	1000	896	859	2875	5640
1967	19	12	2068	232	767	1073	4152
1968	24	40	688	133	1906	904	3671
1969	13	2	180	27	548	932	1689
1970	18	4	588	1071	1308	4231	7202
1971	22	31	850	959	1171	3769	6780
1972	8	4	68	388	75	2806	3341
1973	4	22	46	280	424	1562	2334
1974	13	0	28	62	14	2663	2767
1975	17	. 0	244	5	743	1589	2581
1976	15	7	291	20	436	6026	6780
1977 <sup>a</sup>	13	_	_	_		_	5910
1978	26	1	392	0	7783	705	8881
1979	26	0	320	35	741	1658	2754
1980	22	7	3195	5	3170	1715	8092
1981	10	8	255	110	765	5845	6983
1982	27	23	405	100	4345	684	5557
1983 <sup>b</sup>	3	17	261	_	615	299	1192
1984 °							
1985 °							
1986 °							
1987 °							
1988 °							
1989 <sup>d</sup>	15	28	535	472	395	410	1840
1990 °							
1991 °							
1992 °							
1993 °							

<sup>&</sup>lt;sup>a</sup> Species composition estimated at 75% chum, 10% pink, 10% sockeye and 5% chinook and coho combined. <sup>b</sup> Data collected from returned catch calandars. Due to low return of calendars and absence of household surveys, the resultant catches are incomplete and not comparable to past years.

<sup>&</sup>lt;sup>c</sup> Surveys not conducted.

<sup>&</sup>lt;sup>d</sup> Survey conducted by Subsistence Division and contacted 15 of 43 households in Brevig Mission.

Appendix Table B2. Comparative sockeye salmon aerial survey estimates, Port Clarence District, 1963–1993.

	Salmon	Grand Central			
Year	Lake	River	Total		
1963	866	620	1486		
1964 °	76	590	666		
1965	250	160	410		
1966	1120	370	1490		
1967	129	280	409		
1968 °	830	645	1475		
1969	24	171	195		
1970 a	_	_	-		
1971	538	512	1050		
1972 °	680	300 b	980		
1973	1747	607	2354		
1974	820	0	820		
1975	537	123	660		
1976	132	22	154		
1977	317	235	552		
1978	822	280	1102		
1979	1250	261	1511		
1980 °	512	175	687		
1983	970	_	970		
1984	445	30	475		
1985	730	250	980		
1986	2125	160	2285		
1987	4040	530	4570		
1988	1195	6	1201		
1989	3055	525	3591		
1990	2834	926	3760		
1991	3790	1570	5360		
1992	1500		1500		
1993	3092_	<del></del> :	3092		

<sup>a No survey made.
b Boat survey.
c Poor survey.</sup> 

#### KOTZEBUE SOUND

## History

The Kotzebue District supports the northernmost commercial salmon fishery in Alaska (Figure 3). The recent commercial fishery opened under state management in 1962. Salmon harvests consist primarily of chum salmon, although a few chinook salmon and Dolly Varden are incidentally harvested. There are 218 commercial permit holders, of which an average of 163 were active over the recent 10 year period (1984-1993). Eighty-seven percent are residents of the district and 97 percent are state residents.

The earliest sales of salmon in the Kotzebue District were in 1909 when Lockhart's store handled 21,906 pounds of salmon purchased from eskimos and was resold at \$.05/lb. Of this, 21,366 lbs. were sold to gold miners in the Kobuk River drainage and 540 lbs. were sold to a company in Seattle. A commercial fishery occurred between 1914-1918 when salmon were canned and the bulk of it was also thought to have been sold to miners working in the Upper Kobuk. After state management in 1962, the fishery became fully developed during the mid-70's. Since that time, the fishery has displayed a cyclic pattern of harvest with alternating and declining strong and weak returns over four year intervals (Appendix Table C.1., Figure 5). In 1987, the Department began a rebuilding program with an emphasis on attaining escapement goals. Prior to 1987, commercial harvests were more in proportion to the annual chum return. Current fisheries management is based on a comparison of age composition and catch rate in the commercial fishery to the historic fisheries harvest statistics compiled since 1978. The department is presently also utilizing sonar passage estimates for the Noatak River obtained during the latter third of the season when Noatak stocks predominant the return.

Commercial fishing gear is limited to set nets with an aggregate of no more than 150 fathoms per fisherman. Fishermen generally operate with one end on or near shore and with all three shackles (50 fathoms per shackle) connected. A few fishermen also set in deeper channels in the mud flats further out from shore. Most gear used in the district is 5-7/8 inches (14.9 cm) stretch multifillament gillnet.

#### General Information

Commercial harvests in the Kotzebue district for 1993 were 71,071 chum salmon, 55 chinook salmon, and 76 Dolly Varden (Table 10). This was the lowest commercial catch since 1969 and was half the lower end of pre-season outlook range of 150,000. This catch was 23% of the 14 year (1979-1992) average of 306,000. There were 114 permits that fished this year. This is the lowest amount of participants since 1972 (104). The low fishing effort is attributed largely to construction job opportunities available in the region as salmon prices were higher than in recent years.

Seven out of the normal 15 openings were fished for a total of 168 hours in 1993. This was the lowest number of hours fished since the fisheries inception under

state management in 1962 and was 31% of the recent 14 year (1979-1992) average (529). All commercial fishing periods were 24 hours in length during the 1993 season.

# Inseason Management

The primary fishery management objective was to provide adequate chum salmon escapement through the commercial fishery: (1) to ensure sustained runs by allowing adequate natural escapement, and (2) to meet subsistence harvest needs. Fishery management depended on comparing period and cumulative season catch rates to prior years during the early part of the season and the Noatak River sonar counts during the last 4 periods. A comparison of catch rates over the history of the fishery has shown a close relationship to escapement.

Age composition of catches were also closely monitored to determine the strength of age classes in the return. Older salmon tend to migrate into freshwater first; a fact that affects catch rates as the season progresses and affects the fishery managers evaluation of the catch statistics. Weak 3 and 4 year old age classes will tend to depress mid-season catches.

Meetings were held with fishermen throughout the season to distribute information, gain input from local fishermen, and to announce future management strategies. Contact with the Kobuk River subsistence fishermen was maintained. A test fishery began this year on the Kobuk River; however, test fish indices were not used for management purposes because of the lack of historical data. Information from the Kobuk River test fishery is available in a separate report.

# Commercial Season Summary

The Kotzebue Sound commercial salmon season was opened July 8 by emergency order as established by regulation. Commercial catch for the first 3 periods were just below the recent 14 year average however catch per unit effort (CPUE) was above average (Table 14, Figure 6). With catch rates slightly above average for the first 3 periods, periods 4 and 5 were also 24 hours in length.

Catch rates for periods 4 and 5 dropped to 80% and 60% of the historical average. Even more alarming was the significant low number of age-4 fish compared to the average (Table 15, Figure 7). Normally at this time half the fish are age-4. The 4 year old age component for periods 4 and 5 were 25% and 30% of average. Age-4 fish normally make up roughly 65% of the total commercial harvest. Because of the low catch rate and lack of 4 year old fish, period closures were thought necessary to attain escapement goals.

An Emergency Order (E.O.) was issued to close period 6 in order to allow salmon to migrate into the Kobuk River. Period 7 was fished to re-evaluate the age composition of the run. The catch rate was average; however, total harvest was well below normal due to the reduced time and number of fishermen. Because the number of 4 year old fish was still alarmingly low, period 8 was also pulled. Period 9 was fished to re-evaluate age composition and catch rates. The four year old age composition for period 9 was still far below normal (22%). Catch

rates were nearly twice the average. Because most of the fish were caught from interior statistical areas (1 and 4), it was thought that most fish caught were milling and that there were relatively few fish moving into the district.

Noatak River sonar daily counts through the first week of August were above 1990 levels, when only about half of the escapement goal was met (Table 16, Figure 9), but still under 1991 and 1992 levels. Escapement goals were just met in 1992. With the lack of four year old fish and low sonar counts, the district was closed to commercial fishing for the remainder of the season on August 7.

Sikusuilaq Hatchery was expecting a total return of approximately 60,000 fish with a hatchery escapement estimate of 15,000. With the commercial closure, the escapement estimate rose significantly, even though the projected total return was revised downward to 30,000 to 40,000 chum. Normally hatchery fish are caught in the latter part of the season. The commercial fishery closure during August was intended to ensure an adequate wildstock escapement. The desired sonar passage for the end of August count was 100,000 to 105,000. Of that count, 15,000 to 20,000 were anticipated to be hatchery stock. However, the actual number of fish passing the sonar site was thought to be only 20% to 25% greater than the sonar passage count.

Closing the commerical fishery in the Kotzebue District allowed more salmon to enter spawning tributaries. Overall, aerial survey escapement indices suggested that escapement goals were met. The Department realized that we would not have age information from the commercial harvest. Commercial fishermen were contracted to catch salmon during closed periods to continue monitoring of age composition. Continued commercial test fishing indicated that four year olds remained weak throughout the season. Fish from the commercial test fishery were given away to subsistence with assistance from the Maniilaq Traditional Foods Program. Those not used by Maniilaq were given away to other public entities.

The older age class (age-5) of fish tend to dominate the earlier commercial openings with the younger age classes moving through during the latter part of the fishery. During the 1993 season, age-5 fish were dominant throughout the commercial season and commercial test fishing during closed periods. Four year olds were not observed in significant numbers. Normally, four year old fish dominate most of the fishing season. During 1993, age-4 fish were 20% to 60% below anticipated levels for the duration of the season (Appendix C.9.).

Four buyers purchased a total of 602,808 pounds of chum salmon (average weight 8.5) at \$.38 per pound (Appendix Table C.4.), 967 pounds of chinook salmon (average weight 17.6) at an average price of \$2.37 per pound, and 540 pounds of Dolly Varden (average weight 7.1) at an average of \$.10 per pound. The total exvessel value was \$231,413 to Kotzebue area fishermen with an average of \$2,030 for each participating permit holder. All buyers packed their fish in ice and flew them out in the round for processing. Three buyers flew fish to Anchorage, one buyer flew fish to Bethel or to Anchorage where the salmon were taken by truck to Kenai for processing.

# Sikusuilag Hatchery Stock Fishery

The 1993 projected adult return to the Sikusuilaq Hatchery and Kotzebue District was 60,000 chum salmon. By mid-August, the observed return was roughly half the earlier projection. The harvest of hatchery stock in the commercial fishery was estimated to be less than 4,000 chum. With the early closure of the commercial fishery, the hatchery stock migrating into the river was several times the brood stock requirements for the hatchery, despite the poor rate of return. At fishermen's meetings, the department staff estimated that an excess of 20,000-30,000 hatchery stock would return to the hatchery.

Two buyers expressed interest in purchasing the hatchery surplus. This large surplus was not anticipated prior to the season, so no preparation had been made to administer a terminal fishery at the hatchery. The Northwest Arctic Borough (NWAB) poled the potential user groups concerning their feelings about a terminal fishery at the hatchery. The response was generally favorable. The Borough acting on behalf of the public in lieu of an aquaculture association, solicited bids with the proceeds to be distributed evenly between all active commercial fishermen in the 1993 commercial fishery. The commercial fishermen were the user group most severely impacted by the conservation actions during 1993.

The Department prepared an emergency regulation to allow beach seining as a legal gear type and an emergency order to allow management of the fishery by field order to open the lower Noatak River. Department staff were aware of the locations where hatchery stock had been caught during previous years. The NWAB Assembly accepted the only bid, which was well above their minimum, on September 8. On September 9, the in-river fishery began. High water and the associated debris hampered the fishery. Although the catch rates were low, the tagged to untagged fish ratio in the harvest was similar to that at the hatchery race way, 1 to 210 and 1 to 170, respectively. This indicated roughly 20% of the harvest was wild stock. After the initial two days, the buyer chose to send most of the crew home with the intent to call them back when the water levels dropped.

Roe quality in commercial terms was poor. Roughly one third of the fish were overly ripe, and as a consequence was only marketable in a less lucrative market. For this reason, the buyer decided to seek a different wholesaler. There was little fishing activity from September 16 until September 25. The final harvest was verbally reported October 29. Roughly 2,000 chum salmon were harvested in the commercial fishery (Table 13). The chum salmon that were sold were predominantly female. Male salmon and egg take carcasses from the hatchery were transported to Kotzebue for distribution to subsistence users in the middle Yukon villages. Roughly 4,300 salmon from the Noatak River were airlifted to Yukon River villages as part of a state sponsored response to subsistence fishing closures.

Although this fishery did little to alleviate the financial hardship for the Kotzebue commercial fishermen, it did serve as a feasibility study for a terminal fishery on this hatchery stock. Locations where predominantly hatchery stock mill were located. The quality and market for these fish were documented. Some pitfalls concerning the potential for a fishery were identified: it is known that high water drastically affected the success of the fishery and the village of Noatak has expressed reservations over the proximity and potential impact of

the fishery to their subsistence activities.

# Sikusuilaq Springs Hatchery Contribution

The preseason projected total return to the hatchery for the 1993 was estimated to be roughly 60,000 chum salmon. After recognizing a weak salmon return to the hatchery, the inseason estimate was reduced to about half, 25,000 to 30,000 salmon. Post season analysis indicated the total hatchery return for 1993 was 33,000 to 35,000 chum salmon. The season closure on August 7 resulted in a contribution to the commercial catch of only 3,000 salmon. An additional harvest of 2,000 hatchery salmon was taken during the in-river commercial fishery.

#### Subsistence

Door to door subsistence fish surveys were conducted in the villages of Shungnak, Noatak and Noorvik during the third week in December (Table 12). Surveys are conducted at this time so that harvests of all species during the summer and winter can be documented. Subsistence surveys conducted in the fall tend to be incomplete as some families are still fishing at their camps until freeze up.

Overall, people were satisfied with their harvest. The general feeling was that the salmon run was good but high water made fishing difficult. The fall was long, wet and unseasonably warm. This unusual weather caused people who had processed fish to lose a significant amount of their harvest to spoilage. Others concerned about spoilage did not fish until late in the season, and therefore, did not catch the amount they normally would have. In Noorvik, the continually rising water resulted in a couple of people losing their fish racks and fishing gear. The late freeze up and thin ice also kept people from fishing for whitefish under the ice in Kiana and Noorvik. However, a breakup of the river ice during the warm spell in October allowed upper Kobuk River fishermen to put boats back in the water and successfully harvest whitefish.

#### Escapement

The lower Kobuk River tributaries (Squirrel, Salmon, and Tutuksuk) were flown on August 11 and August 26. Weather and water conditions were fair to good for the surveys. Escapements were at different levels for all three tributaries. Peak surveys for the Squirrel River were less than half of aerial escapement goal, the Tutuksuk River index was at the goal and the Salmon River index was nearly double the goal (Appendix Table C.8.).

Only one survey was conducted on the Upper Kobuk. That survey was completed under good conditions and indicated aerial escapement goals were met. The survey, conducted on August 26, was the first of three scheduled surveys and in all probability occurred before peak spawning.

Due to poor weather, only one survey was conducted on the Noatak River (August 23) and it was under poor conditions. Only 38% of the aerial escapement goal (80,000) was enumerated. Sonar escapement indices as of August 10 were 40,000

salmon. As a result of the commercial closure and excess hatchery fish going past the sonar, daily counts beyond that date for this year were not comparable to that of previous years. The sonar had counted 106,000 chum salmon on August 30. Post season this number was reduced to 99,000. Based on previous year's counts when wildstock escapement had been judged to be adequate, a count of 80,000 fish was determined to be the wildstock goal. This year's hatchery escapement was judged to account for an additional 15,000 to 20,000 counts on August 30. On this basis, the Noatak wildstock escapement was judged to be 5%-10% above the goal. The final sonar count of 118,000 on September 13 is an index of both wildstock and hatchery components of the Noatak River chum salmon run. This is the time period when 90% of the run passes the site. The project was extended 2 weeks during 1993 to begin building a better data base for the future.

## Dolly Varden

Incidental catch of Dolly Varden (locally called trout) was virtually non-existent with a catch of only 76 fish. Spawners and wintering Dolly Varden normally migrate through the district during the third week of August. With the district closed to commercial fishing, there was no opportunity for the incidental commercial harvest of trout during their peak migration. Those trout that were caught were sold and sent out iced in the round with salmon.

#### Freshwater Fisheries

Limited commercial harvest of miscellaneous finfish has been allowed since statehood, normally under the auspices of a permit which delineates harvest levels, open areas, legal gear, etc. There was no reported commercial harvest of whitefish, pike, or burbot during the 1993 commercial salmon season. Sheefish are caught and sold predominantly between late October and late March.

There were 10 freshwater permit holders in 1993. Of these 10, two were registered and 1 reported a commercial catch of 1,700 pounds of sheefish (Appendix Table F.1.)

Table 10. Kotzebue District commercial catches of chum salmon, chinook salmon, and Dolly Varden by period, 1993.

Period	Dates	Hours	Number of Fishermen	Chum		Chinook			Dolly Varden			
				Number	Pounds	Avg. Wt.	Number	Pounds	Avg. Wt.	Number	Pounds	Avg. Wt.
1	7/08-7/09	24	24	2,027	17,308	8.5	1	17	. 17.0			
2	7/12-7/13	24	44	4,285	37,273	8.7	8	148	18.5			
3	7/15-7/16	24	55	8,205	71,345	8.7	15	246	16.4			
4	7/19-7/20	24	62	7,572	64,962	8.6	4	73	18.3			
5	7/22-7/23	24	79	7,659	67,533	8.8	10	193	19.3			
6 C	losed Period											
7	7/29-7/30	24	79	14,309	121,565	8.5	6	120	20.0			
8 C	losed Period											
9	8/05 - 8/06	24	88	27,014	222,822	8.2	11	170	15.5	76	540	7.1
10 C	losed Period											
11 C	losed Period											
12 C	losed Period											
13 C	losed Period											
14 C	losed Period											
15 C	losed Period											
Totals	7/09-8/06	168	114	71,071	602,808	8.5	55	967	17.6	76	540	7.1

Table 11. Kotzebue District commercial chum salmon, chinook salmon, and Dolly Varden catch by statistical area, 1993.

	Number	Chum				Chinook			Dolly Varden		
Statistical Area	of Fishermen	Number	Pounds	Avg. Wt.	Number	Pounds	Avg. Wt.	Number	Pounds	Avg. Wt	
331-01	94	35,285	294,939	8.36	21	398	18.95				
331-02	34	6,761	58,306	8.62	8	137	17.13	23	177	7.70	
331-03	17	4,080	36,203	8.87	2	45	22.50				
331-04	30	14,125	121,379	8.59	7	101	14.43				
331-05	14	3,444	29,651	8.61	8	106	13.25	53	363	6.85	
331-06	32	7,376	62,330	8.45	9	180	20.00				
Totals	114	71,071	602,808	8.48	55	967	17.58	76	540	7.11	

Table 12. Kotzebue Area villages of Noatak, Noorvik and Shungnak subsistence harvest of chum salmon, Dolly Varden, whitefish, sheefish, and Northern Pike, 1993.

	Number of				Number of Fish					
Village	Households Interviewed That Fished	Total Household Members	Average Members per Household	Chum Salmon	Dolly Varden	Whitefish	Sheefish	Northern Pike		
Noatak	24	123	5	3,270	4,275	1,760				
Noorvik	27	160	6	8,430	60	11,950	1,470	3,145		
Shungnak	19	86	5	3,730		5,350	971			
Total *	70	369	5	15,430	4,335	19,060	2,441	3,145		

<sup>\*</sup> Subsistence catch estimates represent only households interveiwed that fished.

Table 13. Noatak River commercial in-river fishery estimated catch, 1993.

		Fema	Female		Male <sup>a</sup>		Total *	
Dates	Pounds of Roe	Number	Pounds	Number	Pounds	Number	Pounds	
9/09/93 - 9/13/93	0	744	6,699	496	4,464	1,240	11,160	
10/09/93 - 10/16/93	1,000 *	500 <sup>a,b</sup>	4,502 *	333	3,000	833	7,500	
Total *	1,000	1,244	11,201	829	7,464	2,073	18,660	

<sup>&</sup>lt;sup>3</sup> Estimated
<sup>b</sup> Skein weight samples taken at hatchery averaged 2 lbs. of roe per female.

Table 14. Kotzebue District 1993 commercial and 14 year average catch statistics (1979–1992).

evious Seas 979 – 1992)	ons Averag	ed		Cumulative				
Period	Hours	Number Permits	Catch (x 1,000)	CPUE	Catch (x 1,000)	CPUE	Prop. Catch	
1	24	44	3.4	3.1	3.1	3.1	0.010	
2	24	72	5.4	3.0	8.5	3.0	0.028	
3	24	99	10.0	4.0	18.5	3.5	0.062	
4	25	120	19.4	6.2	37.9	4.5	0.123	
5	28	133	24.6	6.5	62.5	5.1	0.205	
6	30	138	30.8	7.4	91.1	5.6	0.300	
7	38	145	40.6	7.5	128.8	6.0	0.430	
8	40	147	42.5	7.0	171.2	6.2	0.570	
9	43	142	41.8	6.6	213.1	6.3	0.710	
10	41	144	46.8	7.5	256.5	6.4	0.833	
11	44	134	26.4	4.7	279.1	6.2	0.912	
12	45	117	15.7	2.9	292.5	5.9	0.956	
13	42	89	10.0	2.9	301.1	5.8	0.983	
14	39	64	6.0	2.4	305.0	5.7	0.995	
15	41	39	2.8	1.8	306.6	5.6	1.000	

Year:	. 1993				C	Cumulative	
Period	Hours	Number Permits	Catch (x 1,000)	CPUE	Catch (x 1,000)	CPUE	Prop. Catch
1	24	24	2.0	3.5	2.0	3.5	0.029
2	24	44	4.3	4.1	6.3	3.9	0.089
3	24	55	8.2	6.2	14.5	4.9	0.204
4	24	62	7.6	5.1	22.1	5.0	0.311
5	24	79	7.7	4.0	29.7	4.7	0.419
6	Closed Perio	d			29.7		0.419
7	24	79	14.3	7.5	44.1	5.4	0.620
8	Closed Perio	d			44.1		0.620
9	24	88	27.0	12.8	71.1	6.9	1.000
10	Closed Perio	d			71.1		1.000
11	Closed Perio	d			71.1		1.000
12	Closed Perio	d			71.1		1.000
13	Closed Perio	d			71.1		1.000
14	Closed Perio	d			71.1		1.000
15	Closed Perio	d			71.1		1.000

Table 15. Historical average age composition by period for the recent 14 years (1979-1992) and 1993.

4 Year A	vg.		Pei	rcent			Catch	by Age	
Period	Catch	3	4	5	6	3	4	5	6
1	3,351	0.4	37.3	58.8	3.5	13	1,250	1,970	117
2	5,361	1.2	45.3	51.0	2.6	64	2,427	2,734	139
3	10,048	1.7	42.5	50.1	5.7	171	4,270	5,034	573
4	19,394	1.5	53.8	41.9	2.9	291	10,428	8,126	562
5	24,580	1.5	50.5	43.1	4.9	369	12,413	10,594	1,204
6	30,797	1.8	58.9	37.0	2.3	554	18,139	11,395	708
7	40,569	2.9	60.6	34.9	1.6	1,177	24,585	14,159	649
8	42,478	5.2	66.5	26.5	1.8	2,209	28,248	11,257	765
9	41,814	7.5	62.0	28.0	2.6	3,136	25,925	11,708	1,087
10	46,772	6.3	67.3	25.3	1.0	2,947	31,478	11,833	468
11	26,396	14.0	65.4	19.7	1.0	3,695	17,263	5,200	264
12	15,670	15.2	61.4	21.2	2.2	2,382	9,621	3,322	345
13	10,019	14.8	65.9	17.8	1.5	1,483	6,603	1,783	150
14	5,994	12.9	67.6	18.7	0.9	773	4,052	1,121	54
15	2,781	5.5	72.8	20.4	1.3	153	2,025	567	36

Kotzebue Sound commercial catch and age composition, 1993. a

1993			F	ercent		Catch by Age	
Period	Catch	3	4	5	6	3 4 5	6
1	2,027	0.0	12.9	78.8	8.2	0 262 1,598	167
2	4,285	0.4	20.1	67.5	11.3	16 860 2,893	485
3	8,205	0.0	18.6	74.0	6.7	0 1,525 6,070	549
4	7,572	1.1	11.4	81.2	5.9	84 866 6,147	447
5	7,659	0.4	17.2	78.4	4.0	28 1,319 6,004	309
. 6	Closed	1.8	18.4	75.0	4.8	Closed period, age comp. based on comm. test nets.	
7	14,309	2.9	25.5	66.9	0.4	416 3,642 9,574	52
8	Closed	2.7	27.5	68.1	2.2	Closed period, age comp. based on comm. test nets.	
9	27,014	1.5	22.4	73.4	2.7	417 6,050 19,817	730
10	Closed	5.9	39.1	52.0	2.6	Closed period, age comp. based on comm. test nets.	
11	Closed	1.9	42.7	54.1	1.3	Closed period, age comp. based on comm. test nets.	
12	Closed	5.2	36.7	56.0	2.2	Closed period, age comp. based on comm. test nets.	
13	Closed	12.0	40.0	46.7	1.3	Closed period, age comp. based on comm. test nets.	
14	Closed	4.5	39.4	55.8	0.4	Closed period, age comp. based on comm. test nets.	
15	Closed	8.6	41.7	49.2	0.4	Closed period, age comp. based on comm. test nets.	

<sup>&</sup>lt;sup>a</sup> Second period had 0.73; 3rd period had 0.74; 4th period had 0.37; 7th period had .36 percent 7 year old fish.

Table 16. Noatak River Sonar daily and cumulative chum salmon counts, 1990-1993.

	19	990	1!	991	19	992	1	993
Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum
10-Jul			412	412				
11-Jul			275	687				
12-Jul			264	951				
13-Jul			289	1,239				
14-Jul			490	1,729				
15-Jul			785	2,514				
16-Jul 17-Jul			683 133	3,198 3,330				
17-Jul 18-Jul			118	3,448			290	29
19-Jul			82	3,531			372	66
20-Jul	439	439	176	3,707			214	87
21-Jul	861	1,301	170	3,876			29	90
22-Jul	587	1,887	231	4,107			32	93
23-Jul	509	2,396	292	4,399			26	96
24-Jul	980	3,376	246	4,645			96	1,05
25-Jul	615	3,991	543	5,188			159	1,21
26-Jul 27-Jul	602 687	4,593	570 850	5,758 6,608	1 705	1,795	386	1,60
28-Jul	587 2,469	5,180 7,649	850 707	7,314	1,795 860	2,655	356 977	1,95 2,93
29-Jul	1,432	9,081	1,038	8,353	253	2,908	548	3,48
30-Jul	756	9,837	1,419	9,772	355	3,263	722	4,20
31-Jul	1,174	11,011	678	10,450	351	3,614	582	4,78
01 <i>-</i> Aug	626	11,637	1,292	11,742	710	4,324	506	5,29
02-Aug	390	12,027	1,464	13,205	1,482	5,806	1,034	6,33
03-Aug	647	12,674	1,917	15,123	485	6,291	1,283	7,61
04-Aug	445	13,119	5,009	20,132	282	6,573	2,420	10,03
05-Aug	941	14,060	2,746	22,878	1,499	8,072	3,587	13,62
06-Aug 07-Aug	1,076 1,903	15,135 17,039	2,087 2,002	24,966 26,968	1,835 1,161	9,907 11,068	6,115 2,997	19,73 22,73
08-Aug	1,366	18,404	1,563	28,531	3,837	14,905	4,353	27,08
09-Aug	1,594	19,998	890	29,420	1,305	16,210	5,106	32,19
10-Aug	2,086	22,084	744	30,164	1,205	17,415	6,585	38,77
11-Aug	1,983	24,067	1,839	32,003	3,142	20,557	5,569	44,34
12-Aug	2,067	26,134	2,346	34,350	1,474	22,031	3,994	48,33
13-Aug	2,343	28,477	2,837	37,187	1,763	23,794	4,302	52,64
14-Aug	1,982	30,460	6,264	43,451	548	24,342	2,713	55,35
15-Aug	757	31,217	7,087	50,537	1,475	25,817	1,827	57,17
16-Aug 17-Aug	810 1,626	32,026 33,653	5,963 2,852	56,500 59,352	4,667 4,986	30,484 35,470	1,686 1,545	58,86 60,41
18-Aug	1,770	35,422	2,237	61,589	2,804	38,274	1,702	62,11
19-Aug	1,270	36,692	2,291	63,879	3,652	41,926	1,520	63.63
20-Aug	886	37,578	3,068	66,948	4,873	46,799	4,708	68,34
21 – Aug	468	38,046	1,928	68,876	4,444	51,243	7,980	76,32
22-Aug	635	38,681	2,215	71,091	1,429	52,672	3,417	79,73
23-Aug	644	39,325	1,933	73,025	1,080	53,752	2,970	82,70
24-Aug	535	39,860	1,410	74,435	2,561	56,313	2,526	85,23
25-Aug	993	40,853	1,320	75,755	2,204	58,517	2,613	87,84
26-Aug 27-Aug	1,078	41,931	1,464 1,747	77,219 78.066	3,724	62,241	2,467	90,31
28-Aug			1,385	78,966 80,351	5,077 1,428	67,318 68,746	2,232 2,646	92,54 95,19
29-Aug			1,147	81,498	1,319	70,065	1,988	97,18
30-Aug			1,241	82,739	1,010	, 0,000	1,778	98,95
31-Aug							2,492	101,44
01-Sep							1,922	103,37
02-Sep							1,624	104,99
03 – Sep							1,531	106,52
04-Sep							955	107,48
05-Sep							1,338	108,81
06-Sep 07-Sep							891 2,965	109,70 112,67
07-3ep 08-Sep							2,455	115,12
09 – Sep							1,667	116.79
10-Sep							232	117,02
11-Sep							125	117,15
12-Sep							251	117,40
							582	117,98

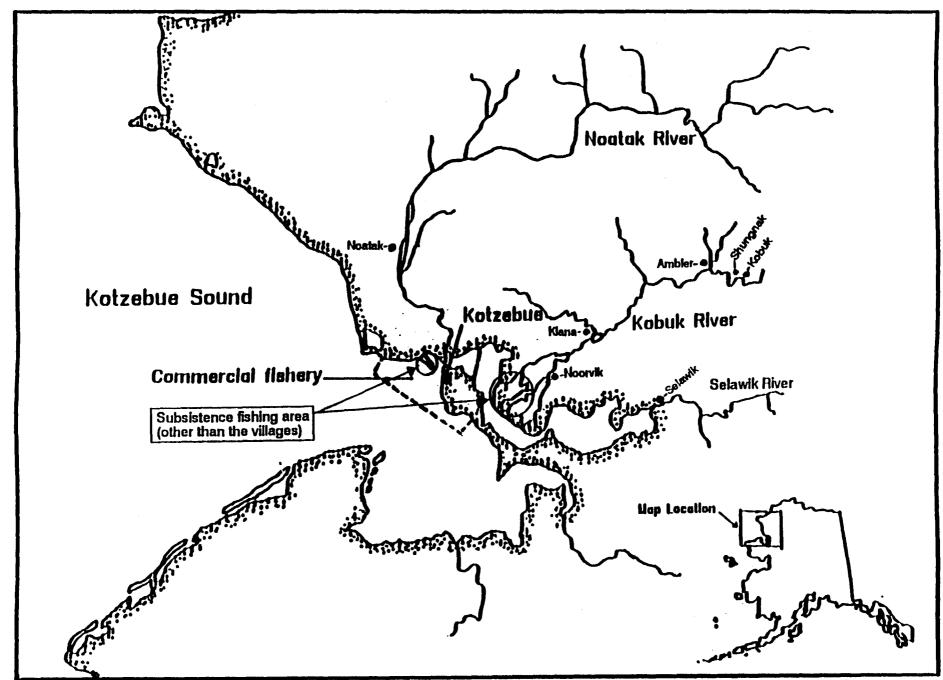


Figure 3. Kotzebue Sound commercial fishing district, villages and subsistence fishing areas, and major chum salmon spawning tributaries.

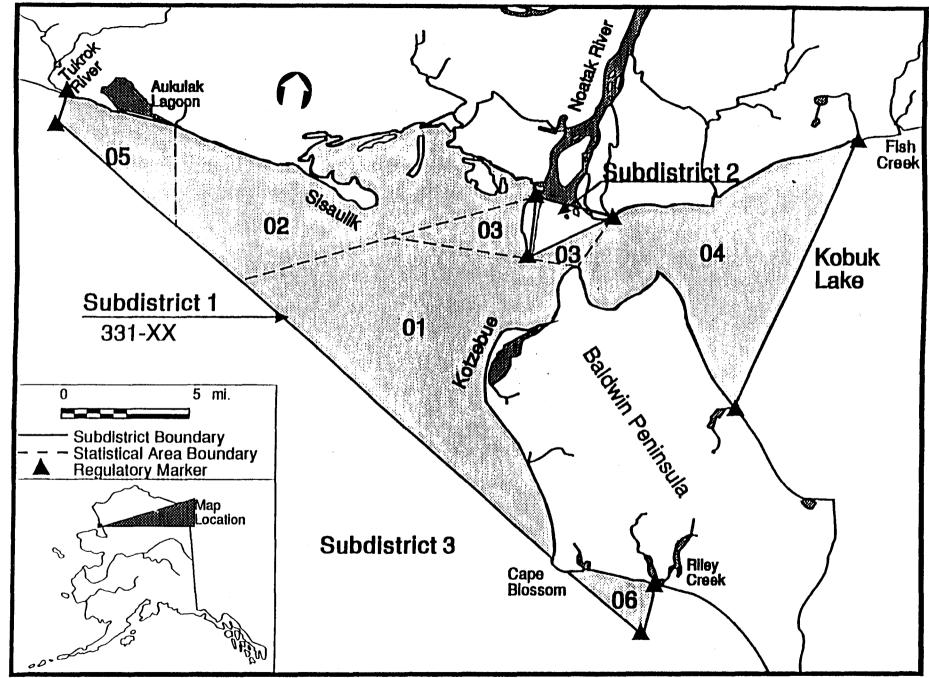


Figure 4. Kotzebue Sound commercial fishing subdistricts and statistical areas.

# Kotzebue District Historical Chum Salmon Commercial Catch

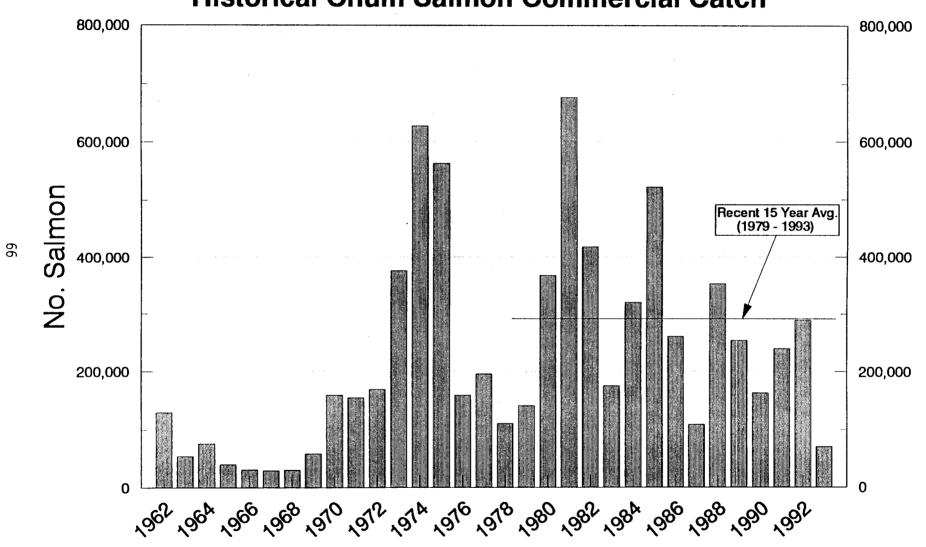
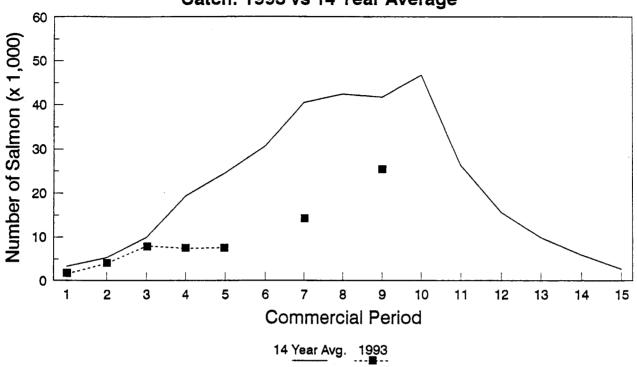


Figure 5. Kotzebue District historical chum salmon commercial catch.

## **Kotzebue Sound Chum Salmon**

Catch: 1993 vs 14 Year Average



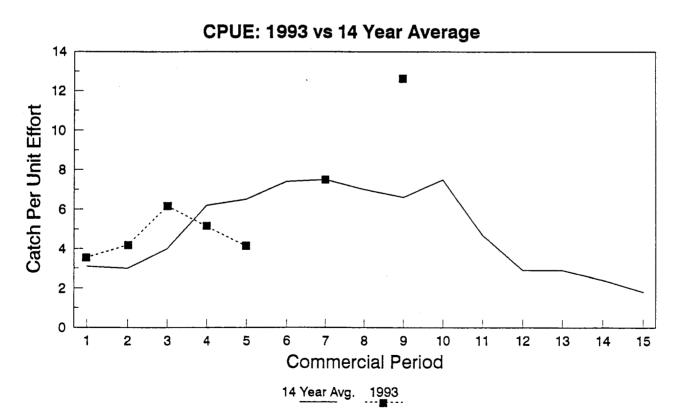
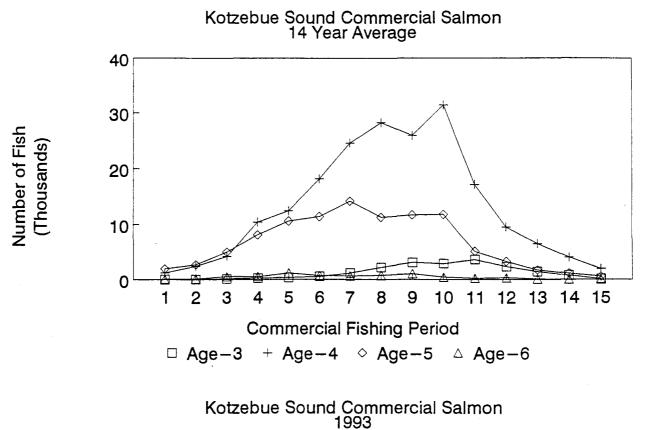


Figure 6. Kotzebue Sound chum salmon 14 year historical (1979-1992) catch and catch rates compared to 1993 catch and catch rates.



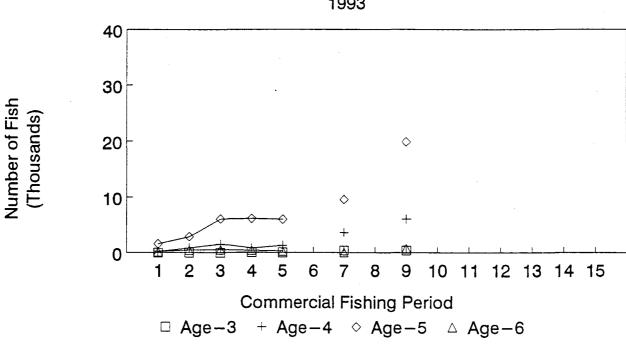


Figure 7. Age in numbers of chum salmon by period comparing recent 14 year average (1979–1992) to 1993.

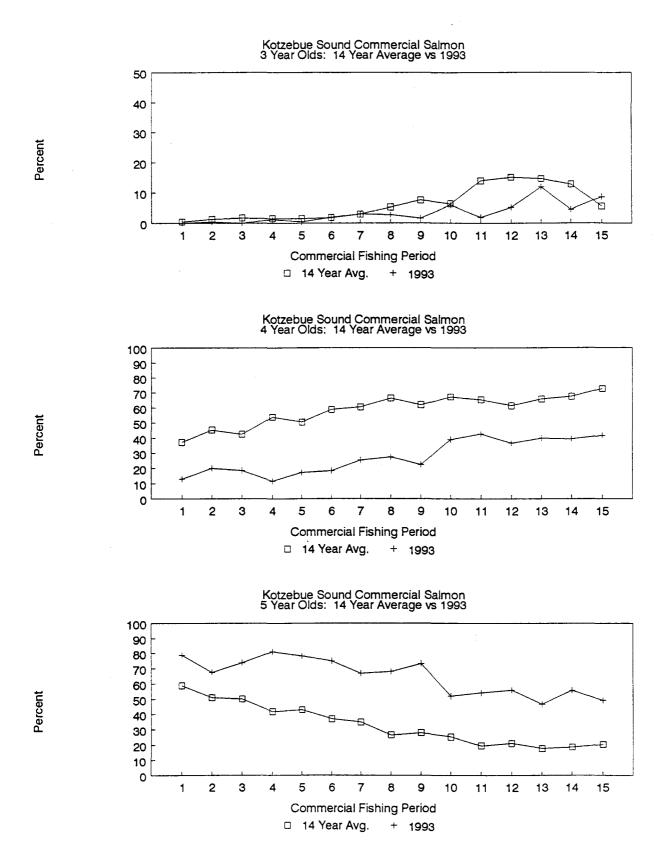


Figure 8. Age composition of chum salmon by period comparing recent 14 year average (1979–1992) to 1993.

## Noatak River Sonar Cumulative Chum Salmon Counts

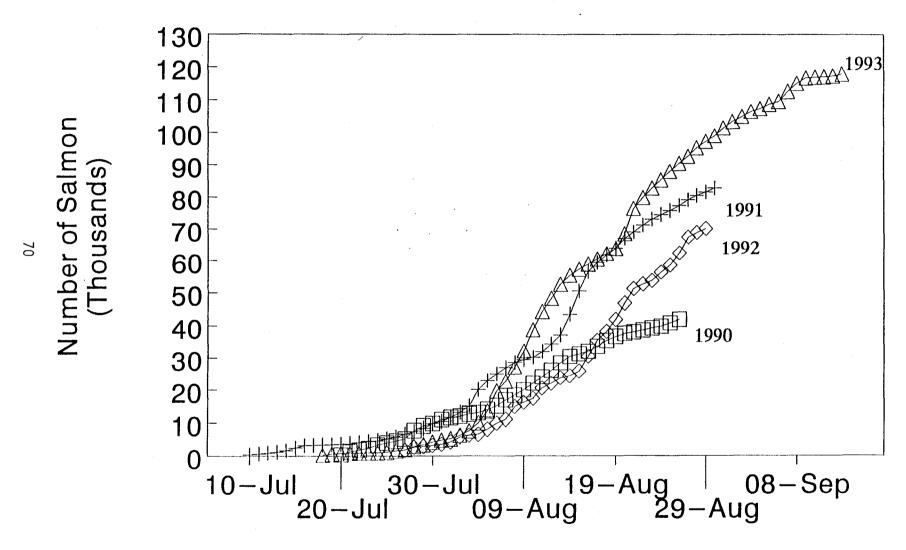


Figure 9. Noatak River Sonar cumulative chum salmon counts, 1990-1993.

Appendix Table C.1. Kotzebue District chum salmon commercial catch statistics, 1962-1993.

Year	Total Catch	Total Days <sup>a</sup>	Total Boat Days <sup>b</sup>	Average Catch per Boat Day	Number of Fishermen <sup>c</sup>	Average Seasonal Catch per Fishermen
1962	129,948	21.0	793	164	84	1,547
1963	54,445	20.0	693	79	61	893
1964	76,449	27.0	560	137	52	1,470
1965	40,025	32.0	410	98	45	889
1966	30,764	35.0	548	56	44	699
1967	29,400	33.0	556	53	30	980
1968	30,212	34.0	858	35	59	512
1969	59,335	40.0	798	74	52	1,141
1970	159,664	32.0	1,368	117	82	1,947
1971	154,956	29.0	1,468	106	91	1,703
1972	169,664	35.0	2,095	81	104	1,631
1973	375,432	25.0	2,217	169	148	2,537
1974 <sup>d</sup>	627,912	32.0	3,769	167	185	3,394
1975 °	563,345	39.0	4,301	131	267	2,110
1976	159,796	16.0	2,236	71	220	726
1977	195,895	21.0	2,353	83	224	875
1978	111,494	23.0	2,738	41	208	536
1979	141,545	21.0	2,462	57	181	782
1980	367,284	27.0	2,559	144	176	2,087
1981	677,239	27.0	3,336	203	187	3,622
1982	417,790	23.5	3,115	134	199	2,099
1983	175,762	12.5	1,557	113	189	930
1984	320,206	19.5	2,432	132	181	1,769
1985	521,406	25.5	3,376	154	189	2,759
1986	261,436	15.5	2,049	128	187	1,398
1987	109,467	11.5	1,160	94	160	684
1988	352,915	21.5	2,761	128	193	1,829
1989	254,617	22.2	1,961	130	165	1,543
1990	163,263	11.5	1,760	93	153	1,067
1991	239,923	22.5	1,795	134	142	1,690
1992	289,184	17.0	1,513	191	149	1,941
1993 <sup>f</sup>	73,071	7.0	431	170	114	641

<sup>&</sup>lt;sup>a</sup> Day = 24 hours of open fishing time.

b Boat days standarized in 1983 for all prior years. Boat days = number of boats fishing times period length in hours divided by 24. Total boat days = total season boat hours divided by 24.

During 1962–1966 and 1968–1971 figures represent the number of vessels licensed to fish in Kotzebue District, not the number of fishermen.
 Includes 6,567 chum salmon from the Deering experimental fishery.
 Includes 10,704 chum salmon from the Deering experimental fishery.

Includes 2,000 chum salmon from the Sikusuilaq Springs Hatchery terminal fishery.

Appendix Table C.2. Kotzebue District chum salmon type of processing and weights, 1962-1993.

	Ch	um Salmon			
Year	Cases (48lbs)	Fresh Frozen (Round weight in pounds)	Other <sup>a</sup>	Fresh Frozen Salmon Roe (pounds)	Cured Pounds
1962	14,500				
1963	5,396				
1964	5,421	202,993			
1965	1,929	207,350			
1966	£	310,716		13,600	3,065
1967		273,420			11,488
1968		288,500			11,850
1969		455,013			8,183
1970		1,240,000			48,377
1971		1,264,753			27,542
1972		1,547,041			55,376
1973		3,416,431			144,768
1974		5,361,130 b			
1975		4,877,313 °			
1976		1,415,549	487		
1977		1,846,340	1,075		
1978		1,009,121	32,419		
1979	-	1,236,429	6,155		
1980		3,160,948	7,828		
1981		6,139,518	2,210		
1982		3,833,051	790	100	
1983		1,647,160	2,449		
1984		2,631,582	1,593		
1985		4,528,379	1,106		
1986		2,271,320	1,691		
1987		900,405	597		
1988		3,060,292	2,120		
1989		2,163,174	1,426		
1990		1,453,040	538		
1991		1,951,041	714		
1992		2,397,302	2,714		
1993 <sup>d</sup>		613,968	1,507	1,000	

Chinook and pink salmon.
 Includes 36,775 pounds from the experimental commercial fishery at Deering.
 Includes 80,801 pounds from the experimental commercial fishery at Deering.
 Includes 11,160 pounds from the Sikusuilaq Springs Hatchery terminal fishery. Pounds of roe stripped are from a verbal report.

Appendix Table C3. Kotzebue District commercial fishery dollar value estimates, 1962-1993.<sup>a</sup>

Year	Gross Value of Catch to Fishermen	Wholesale Value of Pack <sup>b</sup>	License and Tax Revenue to State
1962	\$4,500	\$304,500	\$11,635
1963	\$9,140	\$113,316	\$6,040
1964	\$34,660	\$158,020	\$5,279
1965	\$18,000	\$83,294	\$2,952
1966	\$25,000	\$84,630	\$2,820
1967	\$28,700	\$100,450	\$4,245
1968	\$46,000	\$62,000	\$2,800
1969	\$71,000	f	c
1970	\$186,000	f	\$5,520
1971	\$200,000	f	\$5,970
1972	\$260,000	f	c
1973	\$925,000	f	. С
1974	\$1,822,784	f	\$18,121
1975	\$1,365,648	. <b>f</b>	\$16,955
1976	\$580,375	f	\$15,364
1977	\$1,033,950	f	\$19,960
1978	\$575,260	f	\$9,913 °
1979	\$990,263	f	\$18,302 °
1980	\$1,446,633	f	\$11,820 °
1981	\$3,246,79 <b>3</b>	f	\$11,220°
1982	\$1,961,5 <b>18</b>	f	\$7,085 °
1983	\$420,736	f	\$24,097
1984	\$1,148,884	f	\$39,696 °
1985	\$2,137,368	f	\$6,390 <sup>h</sup>
1986	\$931,241	f	\$5,610 h
1987	\$515,000	f	\$6,1 <b>8</b> 0 <sup>h</sup>
1988	\$2,581 <b>,333</b>	f	\$11,150 <sup>h,i</sup>
1989	\$613,823	f	\$8,350 h
1990	\$438,044	f	\$7,650 <sup>h</sup>
1991	\$437,948	f	\$7,150 <sup>h</sup>
1992	\$533,731	f	\$7,450 h
1993	\$235,061	f	\$5,700 h

<sup>&</sup>lt;sup>a</sup> Some estimates between 1962 and 1981 include only chum value which in figures represent over 99% of the total value. Figures after 1981 represent the chum value as well as incidental species such as char, whitefish and other salmon species.

<sup>&</sup>lt;sup>b</sup> Based on type of processing when fish were shipped out of the district.

<sup>&</sup>lt;sup>c</sup> Includes \$9,193 from the experimental commercial fishery at Deering.

<sup>&</sup>lt;sup>d</sup> Includes \$17,776 from the experimental commercial fishery at Deering.

<sup>&</sup>lt;sup>c</sup> Includes permit and vessel fees only.

f Information not available.

<sup>&</sup>lt;sup>g</sup> Includes tendering fees but not cash bonuses.

h Includes permit renewal fees only; vessels were not required.

i Includes \$3,648 from the Sikusuilag Springs Hatchery terminal fishery.

Appendix Table C.4. Kotzebue District mean prices paid per pound to salmon fishermen by species, 1962-1993 <sup>a</sup>

	Chum	Salmon				
Year	Average Weight	Average Price	Chinook Salmon	Pink Salmon	Inconnu	Dolly Varden
1962		\$0.35 °				
1963		\$0.35 °				
1964	8.3	\$0.45 °				
1965	9.0	\$0.45			\$1.30 <sup>3</sup>	
1966	10.1	\$0.11			\$1.40 <sup>3</sup>	\$0.55
1967	9.3	\$0.11			\$1.50 <sup>3</sup>	\$0.75
1968	9.7	\$0.14			\$0.91 <sup>3</sup>	\$0.98
1969	7.5	\$0.15			\$1.30 <sup>3</sup>	\$2.84
1970	8.1	\$0.15				
1971	8.1	\$0.16			\$0.16	\$0.17
1972	9.1	\$0.17			\$0.20	\$0.17
1973	9.1	\$0.25			\$0.30	\$0.16
1974 <sup>b</sup>	8.5	\$0.34			\$0.30	\$0.16
1975 <sup>b</sup>	8.6	\$0.28			\$0.30	\$0.30
1976	8.9	\$0.41			\$0.30	\$0.30
1977	9.6	\$0.56			\$0.30	
1978	9.1	\$0.57			\$0.30	\$0.25
1979	8.8	\$0.80	•			\$0.25
1980	8.6	\$0.46			\$0.10	\$0.20
1981	9.1	\$0.53			\$0.75 d	\$0.17
1982	9.3	\$0.51	\$1.25	\$0.15	\$0.75 d	\$0.20
1983	9.4	\$0.25	\$1.08	\$0.13		\$0.20
1984	8.2	\$0.44	\$1.03			\$0.25
1985	8.7	\$0.47	\$1.25			\$0.25
1986	8.7	\$0.41	\$1.25			\$0.20
1987	8.2	\$0.57	\$1.25			\$0.30
1988	8.7	\$0.85	\$1.98			\$0.35
1989	8.5	\$0.28	\$1.72			\$0.28
1990	8.9	\$0.31	\$2.00			\$0.25
1991	8.1	\$0.22	\$1.64		\$0.50	\$0.18
1992	8.3	\$0.22	\$1.89		\$0.58	\$0.10
1993	8.5	\$0.38	\$2.37		\$0.50	\$0.10

a Information not available for some species in some years.
 b Includes price paid to fisherment of Deering during the experimental commercial fishery.

c Price per fish.
d Limited market with one buyer.

Appendix Table C.5. Kotzebue District commercial and subsistence salmon catches, 1914-1993.

					Subsiste	nce Chum Ca	tch
	Corr	nmercial Cato	h 		Number of Fishermen	Average Catch per	Total Documented
Year *	Chum <sup>b</sup>	Other °	Total	Chum	Interveiw	Fishermen	Catch
1914	8,550		8,550				
1915	4,750		4,750				
1916	19,000		19,000				
1917	44,612		44,612				
1918	27,407		27,407				
1957				298,430 <sup>d</sup>			
1962	129,948	27	129,975	70,283	81	868	200,258
1963	54,445	143	54,588	31,069	67	464	85,657
1964	76,499	5	76,504	29,762	58	513	106,266
1965	40,034		40,034	30,500	89	343	70,534
1966	30,764	1	30,765	35,588	121	294	66,353
1967	29,400		29,400	40,108	135	297	69,508
1968	30,384 °		30,384	20,814	65	320	51,198
1969	59,335	48	59,383	29,812	99	301	89,195
1970	159,664		159,664	28,486	164	174	188,150
1971	154,956	1	154,957	23,959	152	158	178,916
1972	169,664	3	169,667	11,085	96	115	180,752
1973	375,432	5	375,437	18,942	101	188	394,379
1974	634,479 <sup>r</sup>	48	634,527	26,729	88	304	661,256
1975	563,682 8	36	563,718	27,605	95	291	591,323
1976	159,796	2	159,798	15,765	91	173	175,563
1977	195,895		195,895	9,752	83	117	205,647
1978	111,494	7,007	118,501	12,864	<b>8</b> 5	151	131,365
1979	141,623	910	142,533	14,605	97	151	157,138
1980	367,284	1,654	368,938	10,945	111	99	379,883
1981	677,239	237	677,476	17,766	71	250	695,242
1982	417,790	57	417,847	30,133	204	148	447,980
1983	175,762	229	175,991	8,262 h	46	180	184,253
1984	320,206	107	320,313	15,508 h	66	235	335,821
1985	521,406	63	521,469	13,494 <sup>i</sup>	243	56	534,963
1986	261,436	106	261,542	36,311	837	43	297,853
1987	109,467	44	109,511	j	i	j	109,511
1988	352,915	152	353,067	j	j	j	353,067
1989	254,617	87	254,704	j	j	j	254,704
1990	163,263	32	163,295	j	j	j	163,295
1991	239,923	44	239,967	j	j	j	239,967
1992	289,184	204	289,388	j	j	j	289,388
1993	73,071	131	73,202	j	j	ì	73,202
1979-93						· · · · · · · · · · · · · · · · · · ·	
Average	291,012	270	291,283				

There was no commercial fishing during 1919–1961.

b Catches for 1914—1918 are from pack data only. Number of chum salmon estimate at 9.5 per case (#48) and 34 per barrel.

<sup>&</sup>lt;sup>c</sup> Includes pink, chinook, and sockeye salmon.

<sup>&</sup>lt;sup>d</sup> Estimated mean annual catches prior to 1957 (study by Raleigh).

Corrected from 1968 annual report due to addition of late catches.

<sup>&</sup>lt;sup>t</sup> Includes 6,567 chum salmon from the Deering experimental fishery.

Includes 10,704 chum salmon from the Deering experimental fishery.

h Partial survey.

Does not include harvest from the villages of Noatak and Kivalina.

j Not surveyed.

<sup>&</sup>lt;sup>k</sup> Includes 2,000 chum salmon from the Sikusuilaq Springs Hatchery terminal fishery.

Appendix Table C.6. Kotzebue District subsistence chum salmon catches by village, 1962-1993.

	Village									Villag	je			
Year	Noorvik	Kiana	Ambler	Shungnak	Kobuk	Kobuk River	Noatak Village	Kotzebue	Deering	Kivalina	Buckland	Candle	Shishmaref	District Total
1962	15,934	3,139	ь	b	2,321	21,394	48,890	b	b	ь	ь	ь	b	70,284
1963	4,304	1,973	755	1,240	200	8,472	16,762	5,835	b	ь	. •	ь	ь	31,069
1964	2,167	783	2,142	3,134	1,020	9,246	12,763	7,753	ь	b	b	ь	ь	29,762
1965	5,596	1,598	1,340	2,160	877	11,571	5,671	8,058	5,200	ь	b	b	ь	30,500
1966	3,141	433	912	899	625	6,010	19,700	3,640	6,238	ь	ь	ь	b	35,588
1967	2,350	1,489	679	1,500	175	6,193	26,512	4,032	3,098	b	162	11	100	40,108
1968	2,424	2,488	457	1,600	1,030	7,999	5,490	4,324	2,838	ь	37	89	37	20,814
1969	1,301	2,458	3,525	2,550	1,655	11,489	14,458	1,768	1,897	ь	_	200		29,812
1970	6.077	3,457	2,899	3,450	600	16,483	4,120	6,814	1,242	b	344	113		29,116
1971	7,144	5,177	2,299	2,653	1,931	19,204	9,919	1,737	763	ь	155	50	131	31,959
1972	1,744	1,435	1,469	2,665	2,119	9,432	741	1,151	369	ь	59	113	29	11,894
1973	2.312	4,470	1,529	4,406	1,917	14,634	216	1,172	1,098	ь	1,722	50	100	18,992
1974	6,809	2,726	1,651	6,243	2,251	19,680	4,330	ь	1,880	ь	639	15	200	26,744
1975	4,620	4,320	3,390	9,060	1.755	23,145	1,515	b	1,175	b	1,540	ь	230	27,605
1976	1,555	1,579	2,000	4,213	562	9,909	4,448	b	1,358	ь	b	ь	b	15,715
1977	891	766	385	1,760	325	4,127	2,125	ь	3,500	b	ь	b	ь	9,752
1978	2,034	1.493	2,224	4,766	852	11,369	1,495	b	ь	ь	ь	50	b	12,914
1979	2,155	1.225	2,400	2,947	651	9,378	2,227	ь	2,000	ь	1,000	ь	b	14,605
1980	2,229	2,551	660	2,704	350	8,494	2,135	ь	b	ь	b	b	b	10,629
1981	3,488	1,439	782	2,800	950	9,459	5,465	2,387	295	110	50	, ь	b	17,766 °°
1982	7,433	4,918	2,506	4,191	600	19,648	5,479	4,099	807	210	ь	ь	b	30,243 *
1983 *.d	277	223	1,062	3,556	368	5,486	4,035	347	219	200	ъ	ь	b	10,287
1984 *.*	ь	ь	2,990	4,241	ь	7,231	6,049	88 *	1,940	200	ь	b	b	15,508
1985	7,015	3,494	3,487	3,115	300	17,411	b	13,494	573	ь	ь	ь	b	31,478
1986	8,418	b	b	4,483	b	12,901	1,246	36,311	ь	ь	b	ь	b	50,458
1987	5,092	b	b	1,975	ь	7,067	2,921	ь	b	b	ь	ь	ь	9,988
1988	7,500	b	ь	6,223	b	13,723	b	b	b	ь	b	b	ь	13,723
1989	, , o o o	b	b	3,894	b	3,894	1,595	b	ь	b	b	b	ь	5,489
1990	4,353	ь	b	b,555	ь	4,353	3,915	b	b	b	ь	b	ь	8,268
1991	6,855	ъ	b	4,248	b	11,103	3,637	b	b	b	b	b	b	14,740
1992	8,370	ь	ь	3,890	ь	12,260	2,043	b	b	b	b	b	b	14,303
1993	8,430	b	b	3,730	b	12,160	3,270	b	ь	b	b	b	Ь	15,430

No household survey, information is from return of mail questionaires.
 Not surveyed.
 Does not include 310 chum salmon taken in Selawik.
 Household surveys were conducted in Noatak, Kivalina, and Shungnak only. Other harvest information is from limited return of mail—in calendars.
 Household surveys were conducted in Noatak, Kivalina, Ambler, and Deering. Other harvest information is from limited return of mail—in questionaires.

Appendix Table C.7. Kotzebue District mean subsistence chum salmon catch per fishermen by village, 1962-1993.

Year	Kotzebue	Noatak	Noorvik	Kiana	Ambler	Shungnak	Kobuk	Deering
1962	a	1,190	665	350	a	a	335	a
1963	650	800	160	b	94	b	67	a
1964	515	710	220	260	310	а	205	a
1965	400	810	220	265	190	220	145	a
1966	158	820	137	62	76	45	104	a
1967	202	914	90	68	49	125	35	a
1968	135	220	84	96	33	114	206	a
1969	98	760	163	223	235	318	206	a
1970	187	242	132	138	242	182	150	a
1971	53	148	223	207	177	133	386	a
1972	63	74	84	84	244	266	302	a
1973	195	36	121	178	305	489	273	a
1974	а	393	324	181	165	891	450	a
1975	a	138	210	288	282	647	293	a
1976	а	212	259	79	250	281	70	a
1977	a	425	56	38	55	104	41	a
1978	a	79	88	71	131	265	142	a
1979	a	114	98	68	160	184	108	a
1980	a	164	318	213	132	246	88	a
1981	213	579	388	131	129	233	317	a
1982	84	189	323	246	167	262	200	81
1983 °	50	269	139	223	531	254	368	44
1984	44	173	a	a	214	303	a	194
1985	107	а	206	116	152	195	50	72
1986	47	69 <sup>d</sup>	271	a	a	195	a	a
1987	a	225 <sup>d</sup>	189	a	а	329	a	a
1988	· a	а	300	·a	a	389	a	а
1989	a	133	а	a	а	216	a	a
1990	а	135	198	а	a	а	a	a
1991	a	145	311	а	a	283	a	а
1992	a	89	310	a	a	243	a	a
1993	а	136	312	a	а	196	a	а

<sup>&</sup>lt;sup>a</sup> Not Surveyed.

<sup>&</sup>lt;sup>b</sup> Number of fishermen not known.

<sup>&</sup>lt;sup>c</sup> Means based on very limited number of mail-in calendars except for the villages of Noatak and Shungnak where interveiws were conducted.

d Partial harvest, fishermen were just beginning to fish.

Appendix Table C.8. Chum salmon aerial survey counts for the Kotzebue District, 1962-1993\*.b. (p. 1 of 4)

Stream	1962	1963	1964	1965	1966	1067	1968	1000
ueam	1902	1903	1904	1900	1900	1967	1908	1969
loatak Drainage								
Noatak River below Kelly River	168,000 d	1,970 <sup>bj</sup>	89,798	6,152 <sup>b.j</sup>	101,640	29,120 b	39,394	33,945
Eli River Kelly River & Lake	9,080 <sup>d</sup> 1,818 <sup>d</sup>	35 600		3,155	120 570	225	5,502 ' 375	68 f 150
Relly River & Lake	1,010	600		3,133	570	225	3/5	150
Noatak River System Total	178,898	2,605	89,798	9,307	102,330	29,345	45,271	34,163
obuk Drainage								
Kobuk to Pah River		400		1,750	266		530	
Pah River to just below Selby River		1,530		500			50	
Selby River mouth & Slough		1,045		500	630	1,625	70	
lby R. mouth to just below Beaver C.  Beaver Creek mouth		1,095			460	75 795	170 1,550	
Above Beaver Creek		465			118	793	1,000	
Above bedver creek		700			,,,,			
Upper Kobuk River Total	9,224 <sup>d</sup>	4,535	7,985	2,750	1,474	2,495	2,370	7,500°
Squirrel River	5,834 <sup>d</sup>	2,200	8,009	7,230	1,350	3,332	6.746	6,714
Salmon River	12,936 d	1,535	9,353	1,500 b	3,957	2,116	3,367	2,561
Tutuksuk River	10,841 <sup>d</sup>	670	2,685	.,	1,383	169	823 b	159
Kobuk River System Total	38,835 °	8,940	28,032	11,480	8,164	8,112 °	13,306	16,934

<sup>•</sup> Three aerial surveys are attempted yearly at different intervals for each tributary to assess escapements prior to the peak, at the peak, and after the peak of the run. Indicies listed in this table are the largest survey observed for each tributary during the given year.

of the run. Indicies listed in this table are the largest survey observed for each tributary during the Poor survey conditions or incomplete, early or late survey.

Survey by foot or boat.

These fish are unidentified salmon, mostly chums.

This figure includes fish observed from just above Selby Slough to the mouth of the Reed River.

Unresolvable discrepencies in historical data put this figure in question.

Unclear where these fish were observed.

The figures in this table have been corrected and supercede figures in previous reports.

<sup>&#</sup>x27; Surveyed well before peak of migration.

Unacceptable conditions.

Stream	1970	1971	1972 b	1973 <sup>b</sup>	1974	1975	1976	1977 b	1978	1979
Noatak Drainage										
Noatak River below Kelly River Eli River Kelly River & Lake	138,145	41,056	64,315 3,286	32,144 2,590 <sup>r</sup>	129,640 22,249 1,381 <sup>°</sup>	96,509 1,302 3,937	44,574 1,205 217 <sup>b</sup>	11,221 742 290 b	37,817 5,525 168 <sup>b</sup>	15,721 <sup>b</sup> 1,794 3,200 <sup>b</sup>
Noatak River System Total	138,145	41,056	64,315 <sup>b</sup>	34,734	153,270	101,748	45,996	12,253 b	43,510	20,715
Kobuk Drainage										
Kobuk to Pah River Pah River to just below Selby River Selby River mouth & Slough Selby R. mouth to just below Beaver C. Beaver Creek mouth Above Beaver Creek	1,753 20 4,820 2,385 4,930	4,953 2,039 3,490 4,720 2,000	1,865 7,400 3,170 3,000 2,720	920 850 700	2,255 4,710 7,380 13,775 °	1,873 3,968 4,861 °	485 2,037		269 1,448 211 53	75 183 1,110 640
Upper Kobuk River Total	13,908	17,202	18,155	2,470 b	28,120	10,702	2,522 b		1,981 <sup>b</sup>	2,008
Squirrel River Salmon River Tutuksuk River	4,418 3,000 b 2,000 b	6,628 5,453 1,384 <sup>r</sup>	32,126 2,073 <sup>b</sup>	12,345 6,891	32,523 29,190 8,312	32,256 9,721 1,344 <sup>b</sup>	7,229 1,161 758	1,964 <sup>b</sup>	1,863 <sup>b</sup> 814 <sup>b</sup> 368 <sup>b</sup>	1,500 b 674 b 382 b
Kobuk River System Total	23,326	30,667	52,354	21,706	98,145	54,023	11,670	1,964	5,026	4,564

<sup>\*</sup> Three aerial surveys are attempted yearly at different intervals for each tributary to assess escapements prior to the peak, at the peak, and after the peak of the run. Indicies listed in this table are the largest survey observed for each tributary during the given year.

<sup>&</sup>lt;sup>b</sup> Poor survey conditions or incomplete, early or late survey.

<sup>&</sup>lt;sup>c</sup> Survey by foot or boat.

d These fish are unidentified salmon, mostly chums.
This figure includes fish observed from just above Selby Slough to the mouth of the Reed River.
Unresolvable discrepencies in historical data put this figure in question.
Unclear where these fish were observed.

<sup>&</sup>lt;sup>h</sup> The figures in this table have been corrected and supercede figures in previous reports.

Surveyed well before peak of migration.

Unacceptable conditions.

Stream	1980	1981 <sup>b</sup>	1982 <sup>b</sup>	1983	1984	1985 <sup>b</sup>	1986 <sup>b</sup>	1987 <sup>b</sup>	1988 <sup>6</sup>	1989
Noatak Drainage										
Noatak River below Kelly River	164,474	116,352	20,682	79,773	67,873	45,525	37,227	5,515 <sup>6,j</sup>	45,930 <sup>b,j</sup>	
Eli River	10,277		189	3,044	5,027	<b>855</b>	4,308	2,780	8,639	
Kelly River & Lake	7,416	13,770	11,604	12,137	3,499	1,200	839	950	1,460	
Noatak River System Total	182,167	130,122	32,475	94,954	76,399	47,580	42,374	9,245	56,029	
Kobuk Drainage										
Kobuk to Pah River	1,694	18	2,643 b	2,147	402	2,048 <sup>i</sup>	531			
Pah River to just below Selby River	2,069	309	598 Þ	2,433	257	241 <sup>i</sup>	511	2,250	1,135 <sup>b</sup>	
Selby River mouth & Slough		8,321 d,e	2,454	11,683		711 <sup>i</sup>	673	1,470	820 b	
Selby R. mouth to just below Beaver C.	6,925 <sup>d</sup>		7,268	13,011	5,910	3,278 '	3,282	1,350	6,890 <sup>b</sup>	
Beaver Creek mouth	784		1,711	3,059						
Above Beaver Creek				1,413	4,052		1,018	3,140	3,050 b	
Upper Kobuk River Total	11,472	8,648	14,674	33,746	10,621	6,278	6,015	8,210	11,895 <sup>b</sup>	
Squirrel River	13.563	9,854	7.690	5,115	5,473	6.160	4,982	2,708 °	4,848 <sup>b</sup>	
Salmon River	8.456	4,709	1,821 °	1.677	1.471	2.884	1,971	3,333	6.208	
Tutuksuk River	1,165	1,114	1,322	2,637	1,132	5,098	4,257	206	3,122	
Kobuk River System Total	34,656	24,325	25,507	43,175	18,697	20,420	17,225	14,457	26,073	

<sup>•</sup> Three aerial surveys are attempted yearly at different intervals for each tributary to assess escapements prior to the peak, at the peak, and after the peak of the run. Indicies listed in this table are the largest survey observed for each tributary during the given year.

<sup>&</sup>lt;sup>b</sup> Poor survey conditions or incomplete, early or late survey.

<sup>&</sup>lt;sup>c</sup> Survey by foot or boat.

<sup>&</sup>lt;sup>d</sup> These fish are unidentified salmon, mostly chums.

This figure includes fish observed from just above Selby Slough to the mouth of the Reed River.
 Unresolvable discrepencies in historical data put this figure in question.

<sup>&</sup>lt;sup>8</sup> Unclear where these fish were observed.

h The figures in this table have been corrected and supercede figures in previous reports.

Surveyed well before peak of migration.

Unacceptable conditions.

Stream	1990 b	1991	1992 <sup>ծ</sup>	1993	Aerial Escapement Goals	
Noatak Drainage						
Noatak River below Kelly River	23,345 b	82,750	34,335	25,415	80,000	
Eli River	3,000	2,940	701	4,795	•	
Kelly River & Lake	325	654	726	9		
Noatak River System Total	26,670	86,344	35,762	30,219		
Kobuk Drainage						
Kobuk to Pah River	4,610	9,840	1,030	3,896		
Pah River to just below Selby River	305	2,780	3,820	1,535		
Selby River mouth & Slough		1,040	1,500	1.800		
Selby River	420	1,460	868	824		
Selby R. mouth to just below Beaver C.  Beaver Creek mouth	7,505	5,250	3,845	929		
Above Beaver Creek	2,515	4,155	740	3,174		
Upper Kobuk River Total	15,355	24,525	11,803	12,158	10,000	
Squirrel River	5,500	4,606	2,765	4,463	11,500	
Salmon River	6,335	5,845	1,345	13.880	7,000	
Tutuksuk River	2,275	744	1,162	1,196	2,000	
			·	•	2,000	
Kobuk River System Total	29,465	35,720	17,075	31,697		

Three aerial surveys are attempted yearly at different intervals for each tributary to assess escapements prior to the peak, at the peak, and after the peak of the run. Indicies listed in this table are the largest survey observed for each tributary during the given year.

Poor survey conditions or incomplete, early or late survey.
 Survey by foot or boat.

These fish are unidentified salmon, mostly chums.

This figure includes fish observed from just above Selby Slough to the mouth of the Reed River.

Unresolvable discrepencies in historical data put this figure in question.

Unclear where these fish were observed.

<sup>&</sup>lt;sup>h</sup> The figures in this table have been corrected and supercede figures in previous reports.

i Surveyed well before peak of migration.

<sup>&</sup>lt;sup>1</sup> Unacceptable conditions.

Appendix Table C.9. Kotzebue District commercial age and sex compositon of chum salmon, 1962-1993.

		Pe	ercent	Percent Age Class						
Year	Sample Size	Males	Females	Age-3	Age-4	Age-5	Age-6			
1962	69	26.1	73.9	7.3	63.3	28.0	1.4			
1963	255	35.0	65.0	30.1	50.9	18.6	0.4			
1964	463	43.6	56.4	52.9	45.0	1.7	0.4			
1965	480	42.1	57.9	2.3	91.0	6.7	0.0			
1966	430	40.2	59.8	10.1	67.1	22.8	0.0			
1967	1,865	37.3	62.7	8.8	72.2	18.5	0.5			
1968	1,989	48.2	51.8	21.2	58.1	19.8	0.9			
1969	1,125	53.7	46.3	36.8	58.3	4.9	0.0			
1970	267	45.3	54.7	3.9	91.0	5.1	0.0			
1971	1,105	54.6	45.4	7.1	66.8	26.1	0.0			
1972	980	50.9	<b>49</b> .1	15.8	59.5	24.1	0.6			
1973	598	46.0	54.0	16.7	69.5	13.8	0.0			
1974	350	47.1	52.9	28.5	63.5	7.8	0.2			
1975	340	46.4	53.6	2.5	86.8	10.7	0.0			
1976	566	47.9	52.1	11.2	51.5	37.2	0.1			
1977	446	49.3	50.7	6.7	73.0	18.6	1.7			
1978	579	49.9	50.1	10.5	57.5	31.8	0.2			
1979 <sup>b</sup>	658	53.3	46.7	30.6	53.2	15.2	1.0			
1980 °	710	56.4	43.6	15.1	78.1	6.6	0.2			
1981 <sup>d</sup>	1,167	52.4	47.6	2.4	67.1	30.5	0.0			
1982	983	48.8	51.2	5.9	48.3	40.3	5.5			
1983 °	1,979	43.4	56.6	5.8	57.7	34.2	2.3			
1984 <sup>£</sup>	2,933	50.2	49.8	14.6	64.4	19.7	1.3			
1985 <sup>8</sup>	3,293	47.8	52.2	0.4	83.7	15.5	0.4			
1986 <sup>b</sup>	3,095	46.0	54.0	0.3	18.6	78.9	2.2			
1987 <sup>i</sup>	1,987	52.0	48.0	15.0	43.0	31.0	11.0			
1988 <sup>j</sup>	3,324	48.0	52.0	· 6.5	74.9	16.9	1.7			
1989	3,336	49.3	50.7	0.7	77.9	20.4	1.0			
1990 <sup>k</sup>	2,497	49.4	50.6	2.3	45.6	50.7	1.4			
1991	3,292	46.4	53.6	2.9	60.4	35.8	0.9			
1992 1	3,706	39.9	60.1	0.9	58.5	37.5	3.1			
14 Year Ave (1979 – 1992	•	47.5	52.5	5.1	60.0	32.8	2.2			
1993 <sup>m</sup>	3,707	50.9	49.1	2.9	26.4	66.5	4.2			

<sup>\*</sup> Commercial periods not sampled for years 1962 to 1978 are unknown.

<sup>&</sup>lt;sup>b</sup> Commercial openings 1 and 10 not sampled due to period closure.

<sup>&</sup>lt;sup>c</sup> Commercial openings 8, 13, and 15 not sampled due to period closure.

<sup>&</sup>lt;sup>d</sup> Commercial openings 8, 10, 12, and 14 not sampled due to period closure.

Commercial openings 11, 13, 14, and 15 not sampled due to period closure.

f Commercial openings 14 and 15 not sampled due to period closure.

<sup>&</sup>lt;sup>8</sup> Commercial openings 1, 3, 5, 7, 9, 11, and 13 not sampled due to period closure.

<sup>&</sup>lt;sup>h</sup> Commercial opening 15 not sampled due to period closure.

<sup>&</sup>lt;sup>1</sup> Commercial openings 1, 2, 4, 6, 7, 8, 10, 11, 14, and 15 not sampled due to period closure.

Includes 0.1 percent age - 7 fish.

<sup>&</sup>lt;sup>k</sup> Commercial openings 11 to 15 not sampled due to period closure.

<sup>&</sup>lt;sup>1</sup> Commercial opening 12 not sampled due to period closure.

<sup>&</sup>lt;sup>™</sup> Commercial openings 6, 8, 10, 11, 12, 13, 14, and 15 were closed periods. Closed periods were sampled for age and sex composition from commercial test nets and are included in the 1993 data.

SECTION 2: PACIFIC HERRING (Includes Norton Sound, Port Clarence and Kotzebue Districts)

#### SECTION 2 - PACIFIC HERRING

#### INTRODUCTION

#### Boundaries

The Norton Sound District consists of all waters of Alaska between the latitude of the westernmost tip of Cape Douglas and the latitude of Canal Point Light (Figures 8 and 9). The Port Clarence District consists of all waters of Alaska between the latitude of Cape Douglas and the latitude of Cape Prince of Wales. The Kotzebue District consists of all waters of Alaska between the latitude of Cape Prince of Wales and the latitude of Point Hope (Figure 8).

### Spawning Areas and Timing

The arrival of Pacific herring on the spawning grounds is greatly influenced by climate and oceanic conditions, particularly the extent and distribution of the Bering Sea ice pack. Most herring spawning populations appear near the eastern Bering Sea coast immediately after ice breakup between mid-May and mid-June. Spawning progresses in a northerly direction and may continue into July or August along portions of the Seward Peninsula or within the Chukchi Sea.

The primary spawning areas within Norton Sound have been from Stuart Island to Tolstoi Point. When sea ice has remained in this area into June, spawning has been more extensive along Cape Denbigh and several locations along the northern shore of Norton Sound between Bald Head and Bluff. More northerly spawning areas have been more difficult to identify due to small herring stock sizes and limited investigations. Likely spawning areas include Imuruk Basin, Shishmaref, Deering-Kiwalik, and Hotham Inlet.

#### NORTON SOUND DISTRICT

#### Fishing History

Pacific herring (<u>Clupea harengus pallasi</u>) have been utilized for subsistence purposes by coastal residents prior to the mid-1800's when their use was first documented by early explorers. The earliest American commercial effort on Bering Sea herring apparently took place in the early part of this century at Golovin Bay in Norton Sound (Appendix Table D1).

#### Food Herring

Early records indicate that about 3,200 short tons of "fall herring" were processed in Norton Sound from 1916 to 1941 (Appendix Table D1). This fishery was dependent on salt curing and declined because of poor marketing conditions arising from foreign competition. The Japanese began gillnetting in Norton Sound during 1968 with three vessels. Effort was concentrated about 12 miles offshore

between St. Michael and Golovin. Approximately 40 Japanese vessels reported harvesting a record 1,400 short tons (st) of herring during 1969 (Appendix Table D2). An average annual harvest of approximately 440 st was reported in Norton Sound by the Japanese during 1968-1974. The Japanese gillnet fishery was prohibited in 1977.

#### Sac Roe

Domestic commercial effort resumed in Norton Sound in 1964 near Unalakleet and continued on a sporadic basis until 1979. Between 1964 and 1978 the fishery averaged about 14 short tons of herring annually and targeted on "spring herring" for sac roe extraction (Appendix Table D1). In 1979, a domestic herring fishery for sac roe began on a larger scale in Norton Sound when approximately 1,292 short tons (st) of herring were taken by 63 fishermen (13 purse seiners, 50 gillnetters). Purse seiners took 70% of the total catch.

After the 1979 season, the Alaska Board of Fisheries adopted a public proposal which made gillnets and beach seines the only legal commercial herring fishing gear within Norton Sound. A purse seine fishery could only be opened if the gillnet fleet could not take the allowable harvest. This regulation was an attempt to encourage involvement of local fishermen in this developing fishery. During the 1980 season, 294 gillnet fishermen harvested 2,452 short tons of herring (Appendix Table D3). Because gillnet fishermen demonstrated that they were capable of taking the available harvest, a regulation was passed in 1981 which prohibited any purse seine gear within Norton Sound.

Prior to the 1984 season, the harvest by beach seine fishermen was negligible. During 1984, ten beach seine fishermen harvested 327 st. During their 1984 fall meeting, the Board of Fisheries set a beach seine gear limit of 100 fathoms and limited the harvest to "not exceed 10 percent of the total herring sac roe harvest projection as published by the department." During the fall 1987 Board of Fisheries meetings, beach seine gear was further restricted to a limit of 75 fathoms. Beach seine harvests since 1985 have averaged 6.3% of the total reported harvest.

As with any developing fishery, fishing effort increased with each successive season. In 1984 Norton Sound became a Super-Exclusive Use herring fishing district in order to slow growth and bolster local involvement, but with only limited success. The 1987 season had the highest level of fishing effort on record with a total of 564 fishermen making at least one delivery, where 559 gillnet and 22 beach seine permits recorded landings. This was more than twice the average effort from 1980 through 1986. Local Norton Sound area residents accounted for 36% of the effort and 29% of the total harvest.

A public proposal to the Fall 1987 Board of Fish was adopted that changed the Norton Sound Herring Fishing District to Limited Entry status. Beginning with the 1988 season, a moratorium was placed on Norton Sound where no new entrants were allowed into the fishery. The Limited Entry Commission is reviewing and awarding limited entry permits to fishermen based on fishing history and will eventually reduce the total number to 301 gillnet and 4 beach seine permits as directed by the Board of Fish. Currently, some fishermen have already received

limited entry permits and others are still fishing with interim-use permits while their eligibility is being evaluated on a case-by-case basis.

Commercial harvests from 1981-1984 averaged 4,137 st, and ranged from a low of 3,662 st in 1984 to 4,582 st in 1983 (Appendix Table D3). From 1985-1988, commercial herring harvests have averaged 4,374 st, ranging from a low of 3,548 st in 1985 to a high of 5,194 st in 1986. And most recently, from 1989-1991, harvests have averaged 5,596 st, ranging from 4,743 st in 1989 to 6,373 st in 1990. Level of commercial harvest is influenced by stock status, product value and climatic factors.

#### Spawn on Kelp

A small scale spawn-on-kelp (<u>Fucus</u>) fishery existed in Norton Sound from 1977 to 1984. Harvests during the 1977-1984 period ranged from less than one ton (1977) to approximately 46 st (1981). In addition, during the 1984 season, one ton of macrocystus kelp was imported into Norton Sound resulting in a harvest of approximately 3 st of product. In response to a public proposal, a Board of Fisheries action prior to the 1985 season resulted in the closure of all spawn-on-kelp fisheries in Norton Sound (Appendix Table D5).

#### Management Strategies

The overall statewide management strategy is to annually harvest 0-20% of the herring biomass. The upper end of the exploitation range is applied to stocks in good condition. The lower end of the exploitation range is applied to stocks that are exhibiting a trend of decreasing abundance and poor recruitment. If a minimum threshold level is not achieved, 7,000st for Norton Sound, no commercial fishery will be allowed.

Typically herring are long lived fish and will usually remain harvestable for at least 5 years after recruiting into the fishery. Harvesting only a percentage of the biomass ensures that some fish will be held over for following years. This type of strategy helps mitigate population fluctuations caused by successive years of poor recruitment, a common occurrence in marine spawning fish. Prior to 1983, harvests in Norton Sound were regulated on a subdistrict basis so harvests would be dispersed over the entire fishing grounds. This was to prevent harvest efforts from concentrating in one area on what was then thought to be a distinct stock of fish.

Since methods to reliably forecast herring returns are still being developed and estimates of recruitment are not available, in-season assessments of biomass supersede the projected biomass for management of the Norton Sound herring fishery. The herring biomass will be managed for a 20% exploitation rate if the in-season aerial biomass surveys and age class composition information indicate the run will achieve at least the preseason biomass projection. If the run does not materialize as projected, the harvest exploitation rate may be reduced to a lower level.

Generally, the fisheries management staff has tried to set fisheries openings to allow gillnetters to fish the flood tide as it crests. The belief that the ripe females approach the beach at that time to spawn figures heavily in that strategy. The Norton Sound fishery covers a large area with varying tides. Because the large gillnet fleet can not "fit" into individual subdistricts, opening at the optimal time throughout the district is not always possible. The fishing fleet must be flexible to maximize catches.

The beach seine openings are dependent on herring abundance near the beach and favorable weather conditions for spotters and fishing. Beach seiners prefer to work flood tides similar to those gillnetters favor, however, fisheries managers frequently provide less optimal fishing times. The beach seiners have shown the ability to harvest their allotment of 10% of the preseason harvest goal in a single three hour opening under ideal conditions. By the nature of the gear, beach seiners have the potential to wrap up large numbers of fish greater than their allocation. Therefore, the management staff has often chosen to reduce the beach seine efficiency by allowing a gillnet opening to occur before the beach seine opening in order to break up school size and reduce the likelihood of a bonanza. Occasionally, the beach seine fleet has been used to test the roe quality of herring newly arrived in nearshore waters prior to a gillnet opening where the potential for waste was great had the entire gillnet fleet fished on poor quality herring.

#### 1993 SEASON SUMMARY

The 1993 Norton Sound herring fishery opened by emergency order on May 24. A total of seven gillnet openings occurred for 39.5 hours of fishing, four beach seine openings totalling 11 hours, and two co-oped openings totalling 37 hours. Two educational openings were also allowed for a total of 10 hours fishing. Subdistricts 1 through 5 were closed by news release on June 9. The total harvest based on fish ticket data was 5029.2 short tons (st) of herring (Table 1). In addition, approximately 45.0 st were estimated to have been wasted in abandoned beach seine sets. The total catch is thus 5074.2 st. Since 1981, catches have averaged 4,673 st (Table 2).

There were 264 fishermen who made at least one delivery during the season. This is the lowest effort since 1984, excluding 1992 when there was no fishery. Fishing effort had been declining in recent years as limited entry was put into effect, this season's low effort was in part due to the poor price projected prior to the season, last year's closed season and the drawn out nature of this season.

During the 1993 season, 256 fishermen used gillnets, landing a total of 4286.8 st. The average sac roe recovery for gillnet caught herring was 10.0%. Seven fishermen participated in the beach seine fishery, landing 742.4 st of herring. The average sac roe recovery for beach seine caught herring was 9.0% (Table 3). An effort was made to separate beach seiners from the gillnet fleet to prevent gear conflicts and to enable the Department to better monitor the beach seine fishery. The timing of the beach seine fishery was not coincidental with the gillnet fishery. One educational gillnet permit was issued by CFEC, and fished by the Bering Straits School District commercial fisheries vocational class on

May 30 and 31. A total of 8.7 st was landed on this permit, and is included in the gillnet total harvest.

There were six companies present on the grounds during the season to purchase herring. Two of these companies combined to report as one during the fishery. These 6 companies registered 10 processors and 47 tenders to operate in Norton Sound (Table 4).

The average sac roe recovery for all gear types was 9.9%. The combined sac roe and bait roe percentage was 9.7% roe due to the 320.7 st bait harvest. Based on final operations reports, it appears the average price advanced for a short ton of 10% roe herring was approximately \$300.00. The average price paid to the fishermen for a short ton of 9.9% fish was approximately \$297.00. Of the 5029.2 st harvested, 320.7 st were purchased as bait herring (roe % less than 7.0%) for which fishermen received an average of \$50.00 per ton. The total value of the herring harvest to the fishermen was approximately \$1,411,142.20.

Conditions for aerial observation of herring biomass were fair for the entire season (Table 5). The commercial fishery was managed using the preseason biomass projection. The peak aerial survey of 43,200 made June 2 and 3 combined with estimated harvest as the season progressed approximated the projected biomass. The preseason guideline harvest was 9,054 st, with 8,149 st allocated to the gillnet fishery and 905 st allocated to the beach seine fishery. During the fishery, it was assumed the projected biomass was present and that the preseason guideline harvest could be harvested. The 1993 biomass, including the harvest is estimated to be 46,549 st. The final harvest, 5,029 st, combined with an estimated waste of 45 st gives a total harvest of 5,074 st and an exploitation rate of 10.9 percent.

The aerial surveys of June 2 and 3 verified the preseason projection. Unfortunately, by that time there was little hope of taking the projected harvest. The regular survey schedule was continued through June 7, when the aerial survey fund was exhausted. Pilots and fishermen reported significant herring biomass present in Norton Sound for at least another week. No surveys were flown on a late run of small ripe fish that were reported in the vicinity of Cape Denbigh on June 12.

#### Fishery Management/Emergency Orders

The Norton Sound Herring Management Plan stated that the Department would attempt to manage the fishery for marketable roe recovery. During 1993, industry standards called for 9.0% roe, as opposed to the Department standard of 8.5 in recent years. State of Alaska statutes direct that the resource should be managed so as to maximize the return to the State and the industry. The result of this higher standard was a decrease in the number of openings that could reasonably be expected to meet the quality standard.

The 1993 Norton Sound Herring Management Plan also stated a projected biomass of 45,270 st was expected to return this season. This projected return was based upon the 1992 escapement estimate, using a schedule of increasing natural mortality with age. The 1993 spawning biomass was expected to be dominated by

age 5, 7, and 11 year old herring. If aerial survey observations and age class composition indicated a return of 45,270 st, then 20% or 9,054 st (8,149 st by gillnets, 905 st by beach seines) could be harvested.

Aerial survey conditions were predominantly fair (Table 5). The first survey was flown April 19. Pilot reports during the first week of May reported small amounts of herring. Ice floes interfered with aerial survey efforts until May 23. Predominantly old age herring composed the bulk of the biomass observed near shore through May 28. Ice floes covered the preferred spawning area until May 22, when the ice began to retreat from east to west over the next three days. On May 22, industry spotters reported herring spawning at Tolstoi Point. The fishing fleet was put on 12 hour notice on May 22. On May 23, notice was shortened to 2 hours. Egg deposition had begun and ripe fish were reported at Besboro Island.

The first beach seine opening was held on the morning of May 24. Preliminary reports indicated that the opening yielded nearly 200 st with a mixed bag of roe quality. Because roe quality was good at some locations and early test fishing indicated 9.0% roe was possible, a beach seine opening was scheduled for mid-day and a gillnet opening was scheduled for the evening of May 25. Preliminary reports indicated a beach seine harvest of 189 st with a roe percent of 9.5 and a gillnet harvest of 950 st with a roe quality of 9.5 percent. In order to minimize the harvest rate and to require the fishermen to more closely tend their nets, the gillnet fishery was opened with a restriction to allow no greater than a 50 fathom net limit.

Using the harvest rate from the first opening, a second gillnet opening was announced the following day to meet roughly 1.5 days of processing capacity. The catch rate and quality of the first gillnet opening was such that the subsequent openings were maintained at the one shackle limit. The catch rate was slower than planned so an extension of two hours was allowed. A third gillnet opening held on May 27 produced less than 500 st. The older age classes of fish were cycling out of the fishery and were available only in small pockets.

On May 28, a beach seine opening targeting some of those pockets produced a catch of less than 9.0% quality. The decision to curtail fishing for several days was made in order for the spawned out older age classes to move from near shore waters and allow time for the younger age classes to migrate in. Over the next four days the educational permit fishery and test fishing occurred. Many fishermen made the decision to leave the area for the season.

On June 2, a large biomass of the younger age classes arrived in nearshore waters. Test fishing in the vicinity of St. Michael Island tested well and the gillnet fishery resumed that afternoon. Many fishermen and tender vessels had moved out of the fishery. The fishing fleet was reduced to one-half its size as compared to the week before. Gillnet fishing continued for the next two days exhausting the fishing potential of Subdistrict 1 on June 4. During that time, the beach seine fishermen had agreed to co-op their fishery. The beach seine fleet fished in directly supervised fisheries by staff on the grounds on the evening of June 1 at Besboro Island and on June 3 and 4 near Portage Roadhouse. The gillnet fleet completed their season in the vicinity of Cape Darby on June 5. Test fishing continued the next day, but no concentrations of marketable fish

were found. During late June, three fishermen had continued to fish in the vicinity of Nome and Port Clarence for small quantities of bait. The bait harvests are insignificant in comparison to the earlier sac roe fishery. On June 13, the last test fish samples were collected.

#### Catch Reporting and Enforcement

Buyers registered for the 1993 season were required to report herring purchases daily (8:30 a.m.) and three hours following the closure of each period. As in past years, due to the scheduling of successive openings by gear type, "clean-up" catch reports were requested as soon as catch figures could become available. In general, compliance with requested catch reports was very good. The VHF radio turned out to be the communication equipment of choice due to the range of the SSB radio equipment. Communications with the field camps were accomplished with marine VHF, SSB or by aircraft radio from the aerial survey plane.

Protection efforts in Norton Sound consisted of three single engine aircraft (a super cub on wheels, a helicopter and a C-185 on wheels) and several small boats as well as the P/V Wolstad. Personnel consisted of 8 permanent, full-time Fish and Wildlife Protection officers and four civilian Public Safety employees.

Fish and Wildlife Protection officers patrolled the grounds during each opening and closure. Twenty-five citations were issued for the following sorts of violations: fishing a closed period (late), abandoned nets, vessel registration, over limit gear, improperly marked vessels, fishing without a permit, no photo ID and fishing without a crew member license. In addition, investigations are pending on abandoned gillnet gear and superexclusive use violations. A total of 10.9 st at 10.2% of herring was confiscated by the State of Alaska during the 1993 season.

#### Abundance and Research

Two Department field crews were operational during the 1993 season. One crew operated from Cape Denbigh, and the second crew operated from Klikitarik. The Klikitarik camp had to be closed June 1 due to a limited budget, consequently, little spawn deposition work was done. The test fish crew's presence and sampling efforts on the herring grounds are critical to the proper management of the fishery and biological documentation of the stocks.

Unalakleet field office personnel during the season consisted of the area management biologist, the Norton Sound and Kotzebue assistant area management biologists, the FOA/catch monitor and a catch monitor/public receptionist. In addition, a fisheries technician was hired and a volunteer was brought in to fulfill the commercial sampling requirements. The regional herring biometrician and a seasonal biologist were present to provide overall quality control of herring sampling and assistance with sample collection and procedures, as was the regional supervisor, regional management biologist, and regional research biologist whom assisted the staff in nearly every facet of the operation.

At the time of this report preparation, field data and herring scales collected during the season are being analyzed. The data will be formalized and presented in separate project and management reports later this season.

Table 17. Daily observed peak biomass estimates of Pacific herring, Norton Sound District, 1993.

Date   Flight   Observer   Initials	Survey	<b>/</b>	Sn									
4/19 1.0 CL 5/04 2.0 CL 5/11 3.0 CL 5/12 4.0 CL 5/13 5.0 CL 5/14 6.0 FB/TL 5/15 7.0 CL/TL				awn								
5/04 2.0 CL 5/11 3.0 CL 5/12 4.0 CL 5/13 5.0 CL 5/14 6.0 FB/TL 5/15 7.0 CL/TL	Hours	Rating	No.	Length (mi)	KLK	UNK	CDB	NTB	ELM	GOL	NOM	TOTAL
5/04 2.0 CL 5/11 3.0 CL 5/12 4.0 CL 5/13 5.0 CL 5/14 6.0 FB/TL 5/15 7.0 CL/TL	0.0	laa.	0.0	0.0	0.0				0.0	0.0		
5/11 3.0 CL 5/12 4.0 CL 5/13 5.0 CL 5/14 6.0 FB/TL 5/15 7.0 CL/TL	0.0	ice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5/12 4.0 CL 5/13 5.0 CL 5/14 6.0 FB/TL 5/15 7.0 CL/TL	1.5	ice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5/13 5.0 CL 5/14 6.0 FB/TL 5/15 7.0 CL/TL	2.2	ice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5/14 6.0 FB/TL 5/15 7.0 CL/TL	1.2	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5/15 7.0 CL/TL	1.0	4.0	0.0	0.0	187.9	0.0	0.0	0.0	0.0	0.0	0.0	187.9
5/15 7.0 CL/IL	3.0 2.6	4.0	0.0	0.0	204.8	0.0	0.0	0.0	0.0	0.0	0.0	204.8
	2.6	1.0	0.0	0.0	626.2	462.9	0.0	0.0	0.0	0.0	0.0	1089.1
5/17 8A FB	2.2	4.0	0.0	0.0	45.6	0.0	0.0	0.0	0.0	0.0	0.0	45.6
5/17 8B TL	0.0	4.0	0.0	0.0	18.2	0.0	0.0	0.0	0.0	0.0	0.0	18.2
5/18 9A CL	2.0	4.0	0.0	0.0	177.8	0.0	10.6	0.0	0.0	0.0	0.0	188.4
5/18 9B TL	0.0	4.0	0.0	0.0	411.6	0.0	13.7	0.0	0.0	0.0	0.0	425.3
5/19 10A CL	2.2	3.0	1.0	0.0	159.0	0.0	30.4	0.0	0.0	0.0	0.0	189.4
5/19 10B TL	0.0	4.0	0.0	0.0	258.3	0.0	162.4	0.0	0.0	0.0	0.0	420.7
5/20 11.0 FB	1.1	4.0	0.0	0.0	0.0	0.0	255.5	0.0	0.0	0.0	0.0	255.5
5/21 12A FB	2.1	4.0	0.0	0.0	134.7	0.0	646.1	0.0	0.0	0.0	0.0	780.8
5/21 12B TL	0.0	4.0	0.0	0.0	0.0	0.0	360.0	0.0	0.0	0.0	0.0	360.0
5/22 13.0 CL	2.3	4.0	1.0	0.7	543.1	279.1	2413.3	0.0	0.0	0.0	0.0	3235.5
5/23 14A CL	3.0	4.0	32.0	2.3	457.5	951.2	1230.0	0.0	0.0	0.0	0.0	2638.7
5/23 14B TL	0.0	4.0	28ª	1.3ª	718.8	0.0	1881.4	0.0	0.0	0.0	0.0	2600.2
5/23 15A CL	2.3	3.0	34.0	3.1	1403.8	947.5	2092.0	0.0	0.0	0.0	0.0	4443.3
5/23 15B TL	0.0	3.0	24ª	2.1"	1241.1	901.0	3009.0	0.0	0.0	0.0	0.0	5151.1
5/24 16.0 CL	2.3	4.0	5.0	0.6	823.3	452.0	3848.0	0.0	0.0	0.0	0.0	5123.3
5/25 17A CL	2.5	3.0	42.0	4.5	160.8	1016.5	6841.2	0.0	0.0	0.0	0.0	8018.5
5/25 17B FB	0.0	4.0	50°	3.6	373.0	3720.0	11550.0	0.0	0.0	0.0	0.0	15643.0
5/26 18A CL	3.3	3.0	23.0	3.4	2126.7	1320.8	3228.6	0.0	0.0	0.0	0.0	6676.1
5/26 18B FB	0.0	4.0	0.0	0.0	0.0	334.2	1798.1	0.0	0.0	0.0	0.0	2132.3
5/27 19A CL	2.2	4.0	47.0	8.4	2845.1	95.3	809.2	0.0	0.0	0.0	0.0	3749.6
5/27 19B FB	0.0	3.0	0.0	0.0	0.0	0.0	2196.9	0.0	0.0	0.0	0.0	2196.9
5/28 20.0 CL	0.8	3.0	51.0	4.9	1326.0	1664.0	11282.0	0.0	0.0	0.0	0.0	14272.0
5/28 21.0 CL	2.5	3.0	1.0	0.3	0.0	0.0	18306.8	0.0	0.0	0.0	0.0	18306.8
5/29 22A CL	3.3	3.0	66.0	4.5	3665.7	0.0	5284.2	0.0	0.0	0.0	0.0	8949.9
5/29 22B TL	0.0	4.0	47*	11.94	3475.2	0.0 s	ee note on a	erial survey s	summary.			3475.2
5/31 23A FB	2.4	4.0	0.0	0.0	369.6	0.0	10843.3	0.0	0.0	0.0	0.0	11212.9
5/31 23B TL	0.0	4.0	0.0	0.0	778.0	0.0	12624.4	0.0	0.0	0.0	0.0	13402.4
6/1 24.0 CL		5.0	1.0	0.2	10.6	0.0	4939.9	0.0	0.0	0.0	0.0	4950.5
6/2 25.0 CL	3.4	4.0	22.0	3.5	1695.5	19115.6	17923.0	1542.8	901.2	119.7	0.0	41297.8
6/3 26.0 CL	3.3	4.0	31.0	4.0	1664.4	12354.6	10640.9	2782.8	1563.6	0.0	0.0	29006.3
6/4 27A CL	1.5	5.0	13.0	1.1	1341.1	0.0	0.0	0.0	0.0	0.0	0.0	1341.1
6/4 27B FB	0.0	4.0	25°	1.2ª	3452.2	0.0	0.0	0.0	0.0	0.0	0.0	3452.2
6/4 28.0 CL	3.1	3.0	4.0	1.0	0.0	11091.7	17942.6	1802.2	1281.6	98.8	401.9	32618.8
6/5 29.0 FB		3.0	22.0	1.9	2241.8	66.3	14403.3	321.3	1456.5	456.3	0.0	18945.5
6/7 30A CL	3.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	28.3	0.0	365.7	394.0
6/7 30B TL	3.0	4.0	0.0	0.0	0.0	0.0	22.8	0.0	0.0	0.0	412.2	435.0
6/9 31.0 FB	0.0	3.0	5.0	0.1	0.0	0.0	736.4	671.4	2769.3	15.2	206.8	4399.1
6/15 32A CL	3.0	3.0	0.0	0.0	5.5	5.5					630.eb	630.6
6/15 32B FB	3.0	3.0	0.0	0.0							272.9 <sup>b</sup>	272.9
0/13 32B FB	0.0	0.0	0.0	0.0								
	71.3		401.0	44.5			eak Blomass					1
					1695.5	19115.6	17923.0	2782.8	1683.3	0.0		46549.4

<sup>\*</sup> Data not included in season total.

b Surveyed only from Nome westward.
The primary surveyor is listed first when two sets of initials are listed.

Survey Rating:	1=excellent 2=good 3=fair	Index Areas:	KLK=s.d.1 UNK=s.d.2 CDB=s.d.3	ELM=s.d.5 GOL=s.d.6 NOM=s.d.7
	4=poor		NTB=s.d.4	

4=poor 5=unacceptable

43200.2 Peak Survey: Estimated Biomass: 46549.4 9309.9 Allowable Harvest: 5029.0 Harvest: Waste: 45.0 5074.0 Total Harvest: Exploitation Rate (%): 10.9%

Table 18. Norton Sound herring spawn estimates by subdistrict (s.d.), 1993.

Date	s #	.d. 1 Miles		d. 2 Miles		.d. 3 Miles	s. #	d. 4 Miles		d. 5 Miles	s. #	d. 6 Miles		d. 7 Miles	# #	otals Miles
4/19	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
5/4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
5/11	0	0.0	0	0.0	0	0.0	- 0	0.0	0	0.0	, 0	0.0	0	0.0	0	0
5/12	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
5/13	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
5/14	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
5/15	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
5/17	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
5/18	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
5/19	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0
5/20	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	- 0
5/21	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
5/22	0	0.0	0	0.0	1	0.7	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7
5/23	29	1.2	0	0.0	3	1.1	0	0.0	0	0.0	0	0.0	0	0.0	32	2.3
5/23	22	1.6	1	0.0	11	1.5	0	0.0	0	0.0	0	0.0	0	0.0	34	3.1
5/24	0	0.0	0	0.0	5	0.6	0	0.0	0	0.0	0	0.0	0	0.0	5	0.6
5/25	37	3.7	2	0.0	0	0.0	3	0.8	0	0.0	0	0.0	0	0.0	42	4.5
5/26	16	1.4	0	0.0	7	2.0	0	0.0	0	0.0	0	0.0	0	0.0	23	3.4
5/27	47	8.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	47	8.4
5/28	51	4.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	51	4.9
5/28	1	0.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.3
5/29	66	4.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	66	4.5
5/31	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
6/1	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
6/2	19	3.5	0	0.0	0	0.0	0	0.0	3	0.0	0	0.0	0	0.0	22	3.5
6/3	28	3.9	0	0.0	0	0.0	0	0.0	3	1.0	0	0.0	0	0.0	31	4.9
6/4	13	1.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	13	1.1
6/4	0	0.0	Ō	0.0	Ō	0.0	- 0	0.0	0	0.0	0	0.0	0	0.0	0	0
6/5	12	0.6	Ō	0.0	0	0.0	1	0.0	0	0.0	0	0.0	9	1.2	22	1.8
6/7	0	0.0	Õ	0.0	Ō	0.0	Ó	0.0	0	0.0	0	0.0	0	0.0	0	0
6/9	Ŏ	0.0	ŏ	0.0	ŏ	0.0	0	0.0	2	0.0	Ō	0.0	3	0.0	5	0
6/15	ŏ	0.0	<u>ŏ</u>	0.0	ō	0.0	Ō	0.0	0	0.0	0	0.0	0	0.0	0	0
Totals	343	35.3	3	0	27	5.9	4	8.0	8	1	0	0	12	1.2	397	44.2

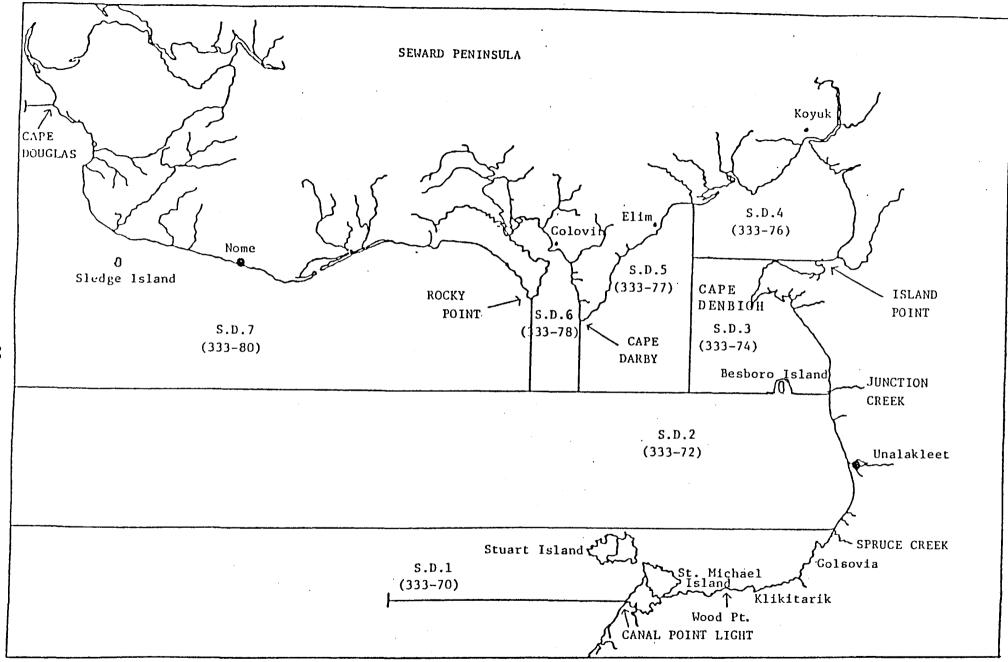


Figure 1Q. Norton Sound commercial herring district (333) and statistical boundaries.

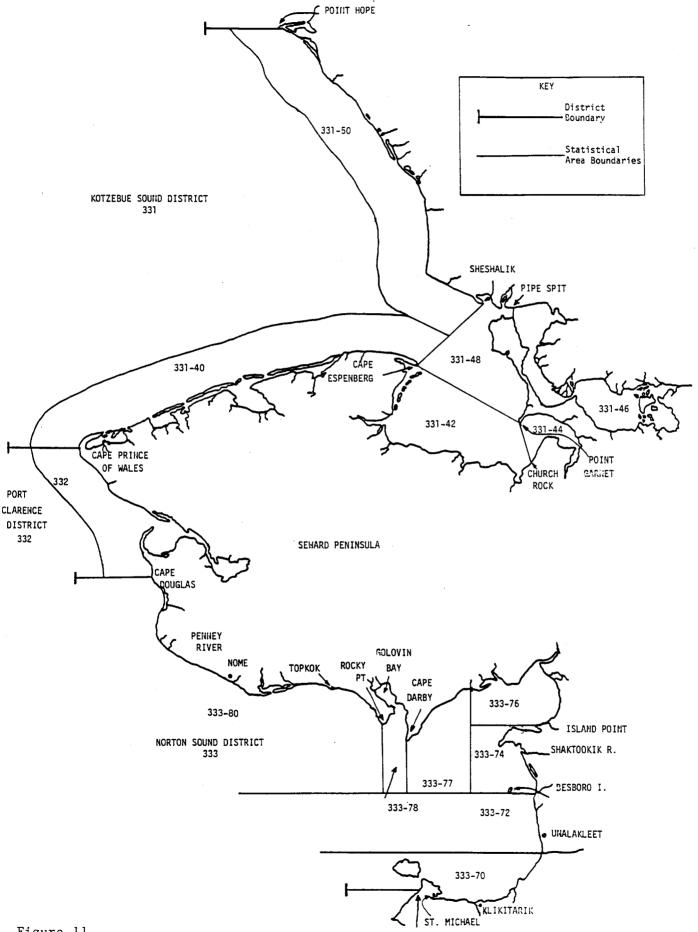


Figure 11.

CAMAL LIGHT POINT

Statistical areas of the Norton Sound, Port Clarence and Kotzebue commercial herring fishery districts.

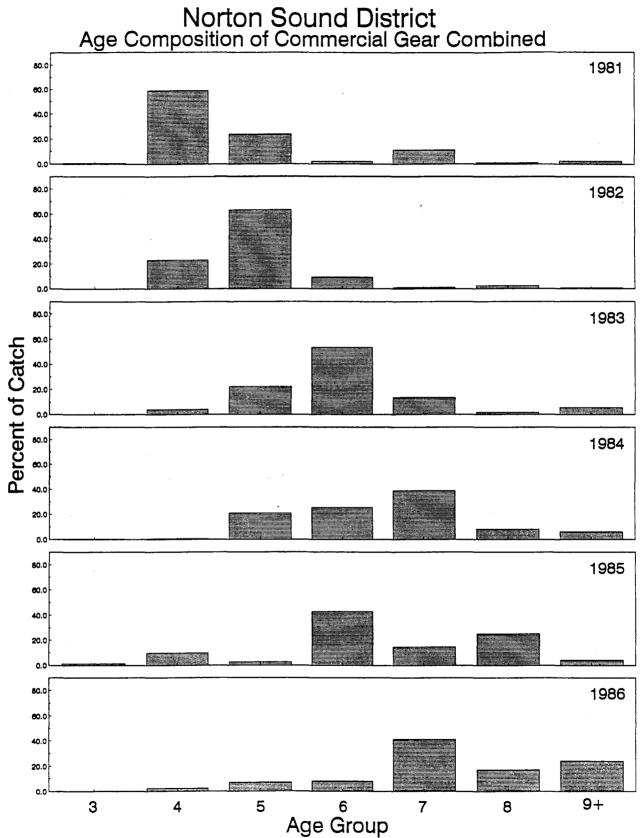


Figure 12. Norton Sound herring age class composition by percentage of commercial catch, commercial gear combined (beach seine and gill nets), 1981-1993. No commercial fishing occurred in 1992.

Norton Sound District Age Composition of Commercial Gear Combined

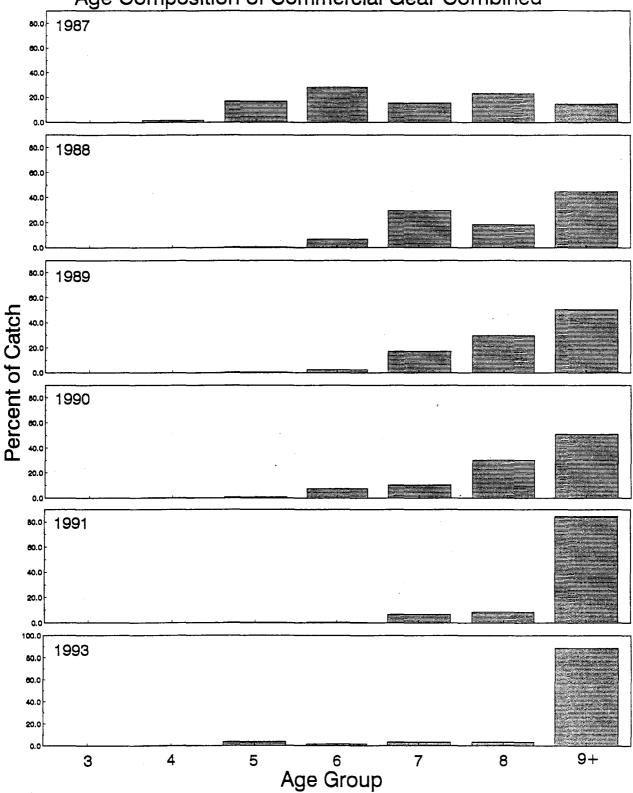


Figure 12. (page 2 of 2)

Norton Sound District Age Composition of Variable Mesh Gill Nets

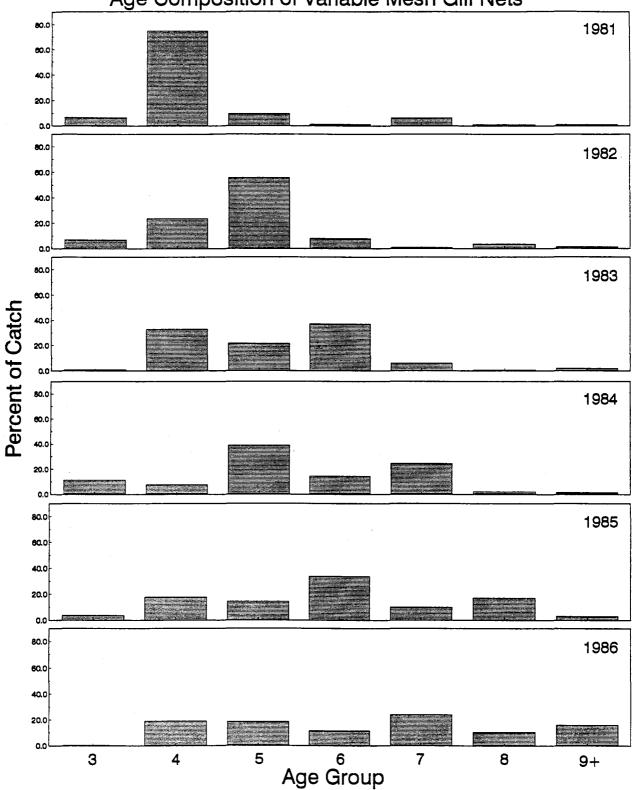
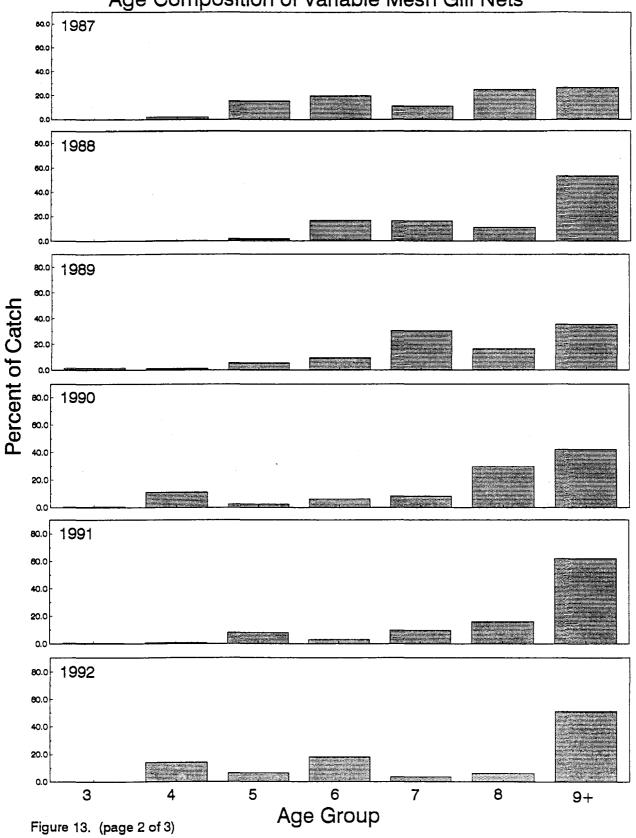
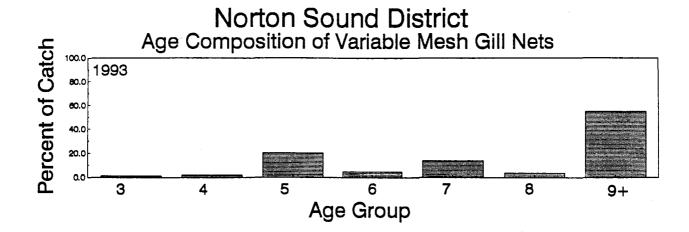


Figure 13. Norton Sound herring age class composition by percentage of total catch, variable mesh gill nets, 1981-1993.

Norton Sound District Age Composition of Variable Mesh Gill Nets





# Norton Sound Herring 1993 Catch by Gear Type and the 1994 Projection

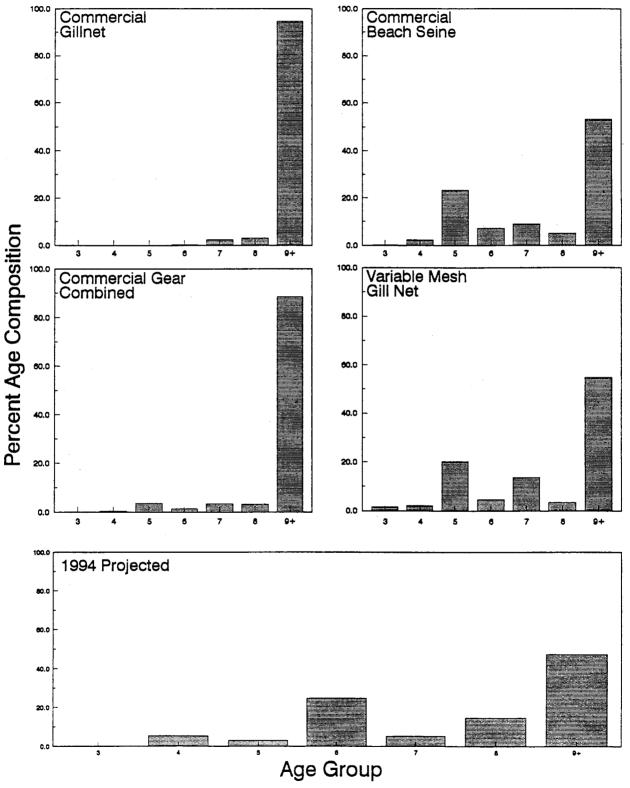


Figure 14. Norton Sound Pacific herring age composition comparison by gear type of capture, 1993, and the projected age composition of the 1994 return.

Appendix Table D1. Norton Sound herring and spawn-on-kelp harvests (in short tons) by U.S. commercial fishermen, 1909-1993.

Year	Sac Roe Herring	Food or Bait Herring	Total	Spawn-on-kelp
<del></del>		- Dair Helling		
1909-1916*	-	-		•
1916-1928	-	1881	1881	-
1929	-	166	166	-
1930	-	441	441	-
1931	-	86	86	-
1932	-	529	529	-
1933	-	31	31	•
1934	-	4	4	-
1935	-	15	15	•
1936	•	•	-	-
1937	•	6	6	-
1938	-	10	10	-
1939	-	6	6	•
1940	-	14	14	•
1941	-	3	3	-
1942-1963	-	-	-	-
1964	20	-	20	-
1965	-	•		-
1966	12	-	12	-
1967	-	-	-	-
1968	-	•	-	-
1969	2	-	2	-
1970	8	•	8	-
1971	20	•	20	•
1972	17	-	17	-
1973	35	•	35	-
1974	2	-	2	-
1975	-	•	-	-
1976	9	-	9	-
1977	11	-	11	trace
1978	15	-	15	4
1979	1292	-	1292	13
1980	2451	1	2452	24
1981	4371	-	4371	47°
1982	3864	- 69	3933	38
1983	4181	401	4582	29°
1984	3298	274	3662	19⁴
1985	3420	128	3548	_*
1986	4926	268	5194	-
1987	3779	303	4082	-
1988	4256	416	4672	-
1989	4494	247	4741	
1990	5253	1026	6379	-
1991	5465	207	5671	-
1992 <sup>f</sup>	-	-	-	_
	4713	321	5034	_
1993	4713	321	5034	-

Fishery occurred some years, but harvest unavailable.
Fishery from 1909-1941 occurred near Golovin; 1964 to present has occurred in southeast Norton Sound.
Does not include approximately 6 st of wastage.
Does not include approximately 2 st of wastage.
Includes 3 st of spawn on Macrocystus kelp.
All componentals fisheries closed by regulation prior

<sup>\*</sup> All spawn-on-kelp fisheries closed by regulation prior to the 1985 season.

No commercial fishery took place in 1992.

Appendix Table D2. Japanese gillnet herring catches in Norton Sound, 1968-1977. (North of 63 N. Latitude and East of 167 W. Longitude)

Year	Gillnet Catch (st)	Remarks
1968	131	First foreign effort on herring in Norton Sound
1969	1400	Peak catch with large effort (about
1970	69	40 ships). Two vessels apprehended.
1971	703	
1972	15	
1973	38	
1974	764	
1975	0	
1976	-	Data unavailable.
1977	-	Herring fishery closed to foreign nations.
Total	3120	Excludes 1976 catches.

Year	Biomass <sup>a</sup> (st)	Harvest <sup>b</sup> (st)	Percent Exploit- ation <sup>c</sup>	Roe %	Dollar Value (millions)	Number Fisher- men
1979	7,700	1,292	16.8	7.0	.6	67
1980 <sup>d</sup>	8,400	2,452	29.2	8.1	.5	294
1981	25,100	4,371	17.3	8.8	1.5	332
1982 <sup>d</sup>	17,400	3,933	22.6	8.8	1.0	237
1983	28,100	4,582	16.3	8.6	1.4	272
1984	23,100	3,662 <sup>e</sup>	15.8	10.3	.9	194
1985	20,000	3,548	17.7	9.9	1.4	277
1986	28,062	5,194	18.5	9.6	2.9	323
1987	32,370	4,082	12.6 <sup>f</sup>	8.6	2.6	564
1988	33,924	4,672	13.8 <sup>g</sup>	9.0	3.9	348
1989	23,857 <sup>h</sup>	4,771 <sup>i</sup>	20.0 <sup>h</sup>	9.2	2.3	357
1990	35,522	6,439 <sup>j</sup>	18.0	8.7	3.6	365
1991	42,854	5,796 <sup>k</sup>	13.5 <sup>f</sup>	9.3	2.4	279
1993	46,549	5,0341	10.9	9.9	1.5	264

Methods of calculating biomass have varied over the years.

Biomass estimates listed follow methods used during that year.

Includes both bait and sac roe harvests.

Minimal biomass estimates due to poor survey conditions.

Includes an estimated 90 st of wastage.

Peak biomass was sighted prior to arrival of the commercial buying fleet.
Biomass spotting conditions very poor throughout herring season; peak biomass represents minimum estimate; exploitation rate based on observed biomass.

No herring fishery occured in 1992.

Represents total District exploitation. During many years southern subdistricts are closed because exploitation of the local biomass reaches 20%, while northern subdistricts have remained open because little or no harvest has occurred.

Peak estimate made after the commercial fishery; the fishery was not re-opened due to the high probability of spawnouts present after two consecutive days of heavy spawning.

Includes an estimated 30 st of wastage.
Includes an estimated 60 st of wastage.

Includes an estimated 125 st of wastage.

Does not include an estimated 45 st of wastage.

Appendix Table D4. Norton Sound commercial herring harvest (st) by subdistrict, by year, 1979-1993.

Subdistricts

Year	s.d. 1	s.d. 2	s.d. 3	s.d.4	s.d. 5	s.d.6	s.d. 7	Totals
1979	319	405	555	_	_	_	14	1293
1980	1176	632	632	5	-	7	-	2452
1981	3068	831	471	1	-	_	-	4371
1982	2062	946	925	_	-	_	-	3933
1983	434	1265	2733	·-	65	85	_	458
1984	-		3572	_	-	- -	_	357
1985	1538	188	1675	_	147	_	-	354
1986	2559	-	2450	_	185	_	-	519
1987	2218	174	1690	-	-	-	_	408
1988	3260	99	1307	_	6	_	-	467
1989	3256	60	1425	-	_	_	-	474
1990	4498	950	931	-	-	-	_	637
1991	_	880	4792	_	-	-	_	567
1992 <sup>f</sup>	_	-	-	_	-	-	_	, 1
1993	2288	587	1881	_	278	_	.2	503

Includes herring taken for sac roe and bait.

Does not include an estimated 90 st of wastage.

Does not include an estimated wastage of 30 st in abandoned gillnets.

Does not include an estimated wastage of 60 st in abandoned gillnets.

Does not include an estimated wastage of 125 st in abandoned gillnets.

No commercial fishery in 1992.

Does not include an estimated wastage of 45 st in abandoned beach seine sets.

Appendix Table D5. Norton Sound commercial spawn-on-kelp (Fucus) harvest, 1978-1984.

Year	st	Fishermen
1978	4	9
1979	13	19
1980	24	20
1981	47	22
1982	38	44
1983	29	35
1984	19	32

<sup>&</sup>lt;sup>a</sup> Norton Sound commercial spawn-on-kelp harvest closed by regulation prior to the 1985 season.

### PORT CLARENCE / KOTZEBUE DISTRICTS

#### Introduction

The regulation book states that in the Port Clarence and Kotzebue Districts, herring may be taken from April 15 through November 15, except that herring may not be taken during the open commercial salmon fishing season. However, prior to the 1987 season, no spring sac roe commercial fisheries had ever occurred within these districts. Interest in exploring these stocks has been expressed in recent years by industry personnel operating in the Norton Sound District. However, no large scale effort to develop the fishery has occurred due to the late ice breakup and fishery timing in the Port Clarence and Kotzebue Districts.

The Port Clarence and Kotzebue commercial herring fisheries have been in regulation since 1982. The 1983 and 1984 regulation books set a guideline harvest of 150 mt (165 st) for each district. Since the guideline harvest has never been changed or repealed by the Board of Fisheries, it is assumed 165 st guideline harvest is still in effect. Presently purse seines, beach seines, and gillnets are legal commercial gear within these districts.

Local fishermen from Teller, Shishmaref, and Kotzebue have also expressed increasing interest in exploiting these stocks. While small harvests of herring for food/bait have occurred during the fall, the fisheries in these districts have been limited by lack of markets. Local fishermen and fishery operators in Kotzebue, Brevig Mission and Nome have also expressed interest in developing a spawn-on-kelp fishery within these districts.

### Resource Investigations

Resource investigations of Port Clarence and Kotzebue Sound area herring stocks were conducted by ADF&G from March 1976-September 1978 (Barton 1978). These studies indicated that herring populations from Golovin Bay (Norton Sound) northward differed significantly in size and behavioral characteristics from herring populations occurring in the southern Bering Sea. Differences between populations were summarized as follows (Barton, 1978).

## Seward Peninsula Populations

Southern Norton Sound to Southern Bering Sea Pelagic Populations

Smaller herring at age with lower vertebral counts.

Larger herring with probable higher vertebral counts.

Lower abundance.

Higher abundance.

Subtidal spawning (3m) in shallow bays, inlets and lagoons.

Intertidal and shallow subtidal spawning along exposed rocky headlands.

<u>Zosteria</u> sp. primary spawning substrate.

<u>Fucus</u> sp. primary spawning substrate.

More euryhaline.

Less euryhaline.

Overwinter in shallow bays; water is warmed by river discharge under ice cover.

Overwinter in deep ocean layers near the Pribilof Islands.

Fall (non-spawning) runs documented.

No fall runs documented.

Larval development in brackish water.

Larval development probable in more saline water.

Data collected from herring populations along the Seward Peninsula strongly indicated that a separate stock of herring occurs in the Port Clarence and Kotzebue Sound areas. This does not preclude the possibility of the occurrence of more southern stocks from utilizing this region, i.e, stocks which winter near the Pribilof Islands and migrate to the western Alaska coast to spawn. It is unlikely however, that herring stocks along the Seward Peninsula migrate to the central Bering Sea for wintering, but rather remain in coastal lagoons, bays or inlets which are warmed by river discharge under the ice (Barton 1978). This may be a major factor in explaining size differences, i.e., environmental conditions. Water temperatures and feeding conditions in deep ocean waters are probably more favorable for growth than those in herring winter habitats along the Seward Peninsula, which apparently have become adapted to Arctic conditions (Barton 1978).

Aerial surveys are very difficult in the Port Clarence District due to organic coloring of the waters of Imuruk Basin, Tuksuk Channel, Grantley Harbor and to a lessor extent, Port Clarence. Aerial surveys were impractical in Imuruk Basin and Tuksuk Channel. Additionally, the presence of other species of fish caught in test commercial gear sets indicate the need for verifying any biomass sighted. A further complicating factor within Port Clarence is the spring ice conditions. The Port is a very sheltered body of water which becomes stained to a high degree over the winter and takes some time to clear once the ice melts. Typically, the

outside waters are significantly warmer than the inside waters which are covered by ice longer thereby slowing solar gain and water mixing. Soon after the ice begins to shift the herring move into the warm shallow lagoons to spawn. The herring are invisible to aerial observation once they enter the stained water. The best aerial survey conditions exist just outside the entrance to the Port, where the herring mass just prior to the ice moving. One or two surveys have been flown each of the past five years, but virtually no herring have been observed because the narrow window of time for seeing the fish has been missed.

## Fall Food/Bait Fishery

Although a fall fishery has probably existed for subsistence use within these areas for many years, a commercial venture has only been attempted recently. During the fall of 1986, one fisherman sold 130 pounds of fall herring from the Port Clarence District for \$1.00 per pound. In 1987, a total of 1,100 pounds of fall herring was sold at \$.30 per pound for use as dog food and crab bait. Limited markets will most likely preclude expansion of a fall fishery. Only sporadic sales or exchanges of fall herring occurred in recent years.

## Sac Roe Fishery

The Port Clarence fishermen have been unable to attract a sac roe buyer for their relatively late fishery. During 1991, one individual imported Macrocystis kelp and attempted an open pound. No herring spawned on the imported kelp, although ripe herring were found in close proximity and very light spawn was found on blades of Zosteria nearby.

SECTION 3: KING CRAB
(Includes Norton Sound,
Port Clarence and Kotzebue Districts)

#### SECTION 3 - KING CRAB

#### INTRODUCTION

#### Norton Sound

The Norton Sound section of the Northern district in Area Q is described in the shellfish regulations as all waters east of 168 degrees W. long., between the latitudes of Cape Romanzof and Cape Prince of Wales (Figure 15). shellfish fishery in Norton Sound is for red king crab (Paralithodes Blue king crab (P. platypus) and Tanner crab (Chionoecetes camtschatica). opilio) also occur within this section but are very seldom caught by commercial or subsistence fishermen. Red king crab have been utilized for subsistence purposes by local residents for many years, but the commercial fishery only first began in 1977. In April 1977, the Alaska Board of Fisheries opened an "exploratory" commercial fishery in order to increase the knowledge and commercial utilization of Norton Sound king crab. Since 1976 there have been six National Marine Fisheries Service (NMFS) research trawl studies in Norton Sound. The most recent survey was conducted in 1991. In addition, the State of Alaska Department of Fish and Game (ADF&G) has conducted four research pot fishing studies (Appendix Table E5). Data from population studies, from winter research studies, mining impact studies, and from 17 commercial fishing seasons has greatly increased the knowledge of the Norton Sound king crab. There are two seasons during which crab may be taken commercially: November 15 - May 15 and July 1 - September 3.

#### St. Lawrence Island

The St. Lawrence Island section lies immediately west and north of the Norton Sound Section (Figure 16). The St. Lawrence Island section has been managed by Westward Region's Dutch Harbor office primarily because the Bering Sea crab fleet bases there and has been open to commercial fishing for the same amount of time as the Norton Sound section. The only reported commercial catches to date in the St. Lawrence Island section were made in 1983 when 52,557 pounds of blue king crab were delivered from 13 landings, in 1989, when 3,603 pounds of red king crab and 984 pounds of blue king crab were delivered from 8 landings and in 1992 when 53 pounds of blue crab were landed.

In 1983 the commercial crab fleet concentrated near the southeast shore of St. Lawrence Island. The following year a regulation proposal to close the waters within 10 miles of all inhabited islands within the section was adopted in an attempt to protect stocks targeted by local fishermen and reduce impacts on subsistence marine mammal harvests during the winter. During the 1989 season, relatively few blue king crab were taken near rocks and shoals still open to commercial fishing but red king crab were discovered in low densities near Kivalina, the northern boundary of the section. The villagers of Little Diomede Island have also traded and sold blue king crab with residents of Nome and other villages for years. The Department has not been able to obtain an accurate record of the magnitude of this trade. The remoteness of this village is also

a factor contributing to the lack of catch records. Current regulation allows the commercial harvest and sale of king crab near shore during the winter. However, local residents of St. Lawrence Island had decided not to export any of their winter catch for commercial sale.

#### 1993 COMMERCIAL FISHERY

Norton Sound Summer Commercial Fishery

The 1993 Norton Sound section commercial red king crab season opened by regulation at noon, July 1. The commercial crab fleet consisted of 14 small catcher vessels composed of herring gillnetters and seiner vessels. However, twenty fishermen made deliveries. There was some crew turnover and several fishermen made deliveries to document their participation in the summer fishery should it become important in the future. The first two vessels registered on July 2 but did not report fishing until July 5. The most productive boats registered on July 7. The last vessel to register did so on July 30. The processing vessel Karla Faye was prepared to take deliveries on July 7. The fishing vessels brought slightly less than their allowable limit of 560 pots to fish in Norton Sound. The season was open for 58 days and was closed by emergency order at noon ADT, Saturday, August 28, when it was anticipated a harvest of 340,000 pounds of legal male king crab would be reached. The closure announcement was made with 48 hours notice, between 10:00 a.m. and noon August 26.

All but one of the fishermen returned their fish tickets prior to August 31. The total reported harvest was 335,790 pounds with no reported deadloss (Table 19). The average price per pound of landed crab is thought to be \$1.28 per pound. The catches this season were reported from nine statistical areas (636401, 646401, 646402, 656330, 656401, 656402, 666330, 666401, and 666402). The fleet averaged 16.4 legal crab per pot pulled; a total of 115,913 crab were captured in 7,063 potlifts. The average weight of legal male crab was 2.9 pounds, 0.1 less than the previous season. This small decline in average weight is most likely due to the water content of crab being reduced as they were transported by brailer from the catcher boat to the processing vessel, unlike earlier years when catcher processors composed the bulk of the fleet.

Catch sampling was done by a single ADF&G port sampler stationed in Nome and a single industry observer assigned to the processing vessel. Consequently, no pot lifts were observed and only legal landings were sampled. A total of 17,746 legal male and 29 illegal male crab were recorded (0.2% illegal crab). Male crab were measured for carapace length and condition; the mean carapace length was 119.2mm; the recruit and postrecruit proportions were respectively 31% to 69% (Appendix Table E2).

The Norton Sound guideline harvest level of legal male red king crab for the 1993 season was 340,000 pounds. This conservative quota was set prior to the season using preliminary data from the fall 1991 National Marine Fisheries Service (NMFS) trawl survey, which placed the current population size at about 1/3 of the historic population level. The population of legal male crab has remained fairly stable since 1985, with only a limited increase in the number of legal king crab.

Exploitation levels were maintained near 15% until 1988 when a decline in the number of legal males caused the exploitation rate to be reduced. The guideline harvest level of 340,000 pounds equated to an exploitation of approximately 10%. Authority for establishing a lowered exploitation rate was set by the Alaska Board of Fisheries during the spring 1988 meeting, which amended the existing harvest strategy regulation 5AAC 34.080.

Board of Fisheries regulations specific to Norton Sound Section are:

- 1) 5AAC 34.915, which directs the Department to manage the Norton Sound summer king crab fishery for a harvest of one-half the exploitation rate determined under 5AAC 34.080.
- 2) 5AAC 34.935, which established a closed area with a defined boundary approximating 15 miles from the beach in the Norton Sound section, to protect a long established winter subsistence fishery.

Regulation 5AAC 34.935 (CLOSED WATERS) also allows the Department the flexibility to reduce the closed waters area to allow an efficient harvest of red king crab during the summer fishery. After about a week's fishing, the decision to relax the closure line to roughly 10 miles from the beach was announced for July 15. Average legal crab per pot lift rose from 4 to nearly 17 after the relaxation of the closure line. The decision to relax the closure line was not made earlier because there were relatively few pots deployed and the possibility of the fishing fleet might not have located the legal concentration of crab.

3) 5AAC 39.141 which established the on board observer program for catcher-processors and floating processors. Thus, the processor was required by regulation to have an observer on board their vessel during the 1993 Norton Sound summer king crab fishery.

This was the fourth season that regulation 5AAC 39.141, the mandatory observer program, was in effect for the Norton Sound fishery. Preparation was made prior to orientation in order to prevent observer problems similar to previous seasons from happening again. Observer materials (manuals, codes, forms, etc.), and program coordination was provided by the Dutch Harbor staff member. Additional documentation and substitute forms were provided to the observer by the Nome staff in order to obtain pertinent information specific to the Norton Sound fishery. Orientation of the single observer took place in the Nome office on June 30, and he was debriefed August 29.

During past years, there was a wide range of professionalism among observers; some collected less than the preferred data while others performed all tasks acceptably. Paperwork turned in ranged from very complete and comprehensive, to unusable. The quality of the observer during the 1993 season was good. This is the second season we were satisfied with the observer data.

4) 5 AAC 34.925 (i) and (j), requiring pot tags and limiting vessels of 125 feet in length or less to 40 pots each and larger vessels are limited to 50 pots.

This new regulation, 5AAC 34.925, along with a regulation making Norton Sound a super exclusive registration area was responsible for the change in character of the fishery during the 1993 season. The limit of 40 pots per vessel was only 13% of the average number of pots fished per vessel during 1990, the last unlimited season held in Norton Sound. Apparently, many large vessel owners felt their vessel would not be able to compete economically under the new pot limit and exclusivity requirements. The superexclusive regulation was overturned in mid-July. There was an attempt to close the fishery in order to allow large boats to gear-up and travel North to participate in the Norton Sound fishery, but the season was allowed to continue. No large vessels participated in this year's fishery.

The 1993 fishery occurred over nearly two full months. A slower rate of fishing was anticipated at the Board of Fisheries meeting in March, and the season starting date was advanced to July 1. The Board realized the lower pot limits and the registration requirements would reduce the fishing fleets efficiency. Fishing efficiency was reduced by both the seven day delay in the arrival of the processor and the time it took the management staff to relax the closure line once fishing began. These two factors probably account for delaying the fishery ten days. Unavoidable delays in the fishery were caused by three storms. The first two kept the fleet in port one day each and the third storm caused a two day delay. The larger boats of past seasons continued to fish during the milder storms or the short season was arranged to occur after storms. Some pots were lost during these storms. There was a wide variety of pots used this season, ranging from very light "winter" pots to "seven by sevens". Problems arose when the typical large pot buoys were placed on pots weighing less than 300 pounds. Light weight pots require bullet shaped buoys and pots weighing less than 150 pounds were frequently lost. A bait shortage occurred mid-season. The cost of flying bait in was high and fishermen experimented with less desirable bait and smaller quantities for roughly a week. During the week of the shortage, catches fell but it is still not clear to what extent the fishery was affected. Most of the delays and problems outlined here are associated with new fisheries. Many of these problems can be avoided in the future.

Double shelled and very new shelled crab were being reported during the last week of August. The commercial fisheries in recent years rarely continued past mid-August, so staff had not anticipated this problem. Although the proportion of molting crab was very low, continuing the fishery beyond the regulatory closure date of September 3 does not seem appropriate in future years.

This was the first commercial summer crab season during which a significant portion of the harvest passed through Nome with six fishermen selling a portion of their catch locally. Roughly 3% of the harvest or 11,259 pounds was landed at Nome. The average price per pound in Nome was \$2.20 per pound as compared to the season average 1.28 per pound. There is a potential for additional sales in Nome during future years (Appendix Table E3).

The good weather allowed boarding for tank inspections and registrations of all vessels. Skipper cooperation and compliance with the verbal catch report was initially good, but became somewhat lax as the season progressed. Division of Fish and Wildlife Protection enforcement support was only available when the Department assisted with logistical support during the season.

## Norton Sound Winter Commercial Fishery

Regulation allows a winter through-the-ice commercial fishery in the Norton Sound Section from November 15 through May 15 which typically takes place near Nome. During the winter of 1992-1993, eight commercial fishermen reported selling a total of 1,788 red king crab (Appendix Table E4). The commercial harvest was split between local Nome residents who buy crab directly from the fishermen and Anchorage or non local markets. Crab sell in Nome for about six dollars a piece and Anchorage prices are around \$3.50 per pound. The 1992-1993 winter catch of 4,926 pounds was 15% below the previous 10 year average (1983-1992) and was estimated to be worth about 14,000 dollars. The low level of harvest is thought to be due to a severe storm scouring the beaches near Nome in late just prior to the fishery. The distribution of crab was believed to have a changed as a result of the storm and winter fishermen's mobility to find crab was constrained by ice conditions.

The winter crab fishermen generally use crab pots but some use hand lines to "prospect". Most fishermen consider commercial crabbing to be a sideline and hold other jobs. Usually, two or three fishermen sell the bulk of the crab. Because of the low volume of crab involved, no processor has found it profitable to operate locally. The crab sold locally are all sold fresh as are those shipped to Anchorage or other non local markets. During the mid-winter months fishermen find it difficult keeping the crab from freezing. Many Nome residents prefer to buy frozen crab since they are able to extract the meat prior to cooking. Fresh frozen crab are easily marketed in Nome, but are not accepted in Anchorage.

#### SUBSISTENCE FISHERY

Red king crab are utilized by Norton Sound residents mainly during the winter. Fishing occurs through holes or cracks in the ice with the use of handlines and pots. In order to document trends in the subsistence harvest, the Board of Fisheries enacted a regulation in 1977 requiring subsistence fishermen in Norton Sound to obtain a permit prior to fishing and record daily effort and catches on these permits (Appendix Table E4).

The first year subsistence permits were required had the highest number of permits issued to date with a relatively high harvest rate. The fishery declined sharply the following year and remained at very depressed levels through the 1981-82 season. The lack of success in the winter crab fishery during some past years has been attributed to a declining crab population caused by removal of crab in the summer commercial fishery together with low recruitment, low effort due to poor ice conditions, and changes in the near shore winter distribution of crab. All of these factors probably had some effect on the success of the winter fishery in varying degrees. During the 1978-79 winter fishery, the king crab population was still relatively high. Despite this relatively large population, winter catches were the poorest on record indicating that the major factors limiting winter catches during 1978-79 were probably poor ice conditions and the distribution of crab. During the winter of 1981-82, poor winter catches could more reasonably be attributed to a declining crab population resulting from poor recruitment rather than the effects of commercial catch removals since the crab

population was at its lowest documented level. Subsistence fishing success during the winters of 1982-83 through 1986-87 had improved due to a rebuilding of the population and increased use of more efficient gear (pots instead of handlines). Unstable ice conditions and record snowfalls adversely effected the 1987-88 catch. In the recent three years prior to 1992-93, approximately 100 fishermen had averaged 100 crab each (Appendix Table E4).

The winter crab fishery is limited by extreme weather conditions. Shorefast ice can become unstable where crab pots may be carried away or fishermen are unable to cross open leads to get to their pots. Low air temperatures, wind and drifting snow are the primary factors that determine effort levels rather than crab densities. The 1992-93 winter subsistence harvest was the lowest on record since the 1980-81 season which is believed to be due to the 1992 Fall storm redistributing the local stock.

## STOCK STATUS/RESEARCH

In 1976 when monitoring of the Norton Sound king crab population first began, the population was mainly composed of prerecruit and recruit crab (Appendix Table E2, Figure 18). This first population assessment survey by the NMFS estimated the legal male king crab population at 8.1 million pounds (Appendix Table E3). The legal male crab population peaked in 1978 at an estimated 11 million pounds. During the 4 years following 1978, recruitment into the legal male crab population was very low. Subsequent NMFS surveys in 1979 and 1982 documented a population of predominantly postrecruit crab, and estimated a decline in the population to 2.6 million pounds by 1982. The Department of Fish and Game conducted their first population assessment survey in 1980, with subsequent surveys in 1981 and 1982 (Figure 19). These survey assessments documented a similar decline from 6.6 million pounds (1980) to 1.3 million pounds (1982). Beginning in 1981, sublegal crab abundance began to increase, and by 1983 recruitment into the legal male population also began to increase. No assessment work was conducted in 1983 or 1984. However, samples of the commercial catches indicated a significant increase of recruit crab into the legal male population; from a historic low of 10% in 1981 to 59% in 1984 (Appendix Table E2).

In 1985, both NMFS and ADF&G conducted population assessment surveys in Norton Sound (Appendix Table E5, Figures 18 and 19). The Department fished 65 stations throughout Norton Sound capturing 4,645 legal males, of which one-third was tagged. Subsequent recapture of tagged crab by the commercial fleet in August of 1985 provided tag to untagged ratios, and the population prior to the fishery was estimated at 2.4 million pounds (Appendix Table E5). After the commercial fishery in 1985, NMFS conducted a population assessment survey using trawl gear over a slightly larger area than that surveyed by the Department. Catches of male king crab by NMFS were in the process of or had just molted with the result being that the estimate of 3.4 million pounds of legal male king crab included some recruitment. Adjusting this estimate for molting, and including the summer commercial harvest, the estimate became 3 million pounds present prior to the 1985 August fishery. Both surveys documented relatively substantial numbers of recruit crab and a healthy percentage of prerecruit crab.

During September of 1988, NMFS conducted a fourth population assessment with trawl gear. They swept an area roughly the same as in 1985, but increased sampling frequency in the proposed mineral lease area near Nome. The timing of the study was almost a month earlier than similar surveys in the past, which occurred during the male molt. Nearly all the 1988 catch was in pre-molt condition. NMFS estimated 3.0 million pounds of legal male and 1.0 million pounds of prerecruit-one male red king crab; totaling 4.0 million pounds. Annual mortality is approximately 20% or in this case 0.8 million pounds. Ignoring growth and the winter harvests the population prior to the 1989 summer fishery would have been 3.2 million pounds, very close to the 1985 trawl estimate of 3.4 million pounds.

NMFS conducted a fifth trawl survey of Norton Sound during late August 1991 with a reduced number of tows from past surveys. Each station had only a single sampling tow as compared to each station having both a day and night tow during previous surveys. This reduction in sampling has the affect of introducing more variability into the estimate. The legal crab biomass in the summer fishing area was estimated to be 3,400,000 pounds and the total Norton Sound legal biomass was estimated to be 4,009,000 pounds. Since the survey occurred prior to the molt, a mortality of 10% was assumed for the year since the estimate was made. Since no additional surveys have been conducted for two years, the conservative biomass of 3,400,000 pounds was used as the basis for the 1993 harvest guideline. The Norton Sound red king crab population is thought to be quite stable when harvested near 10%.

#### **FUTURE INVESTIGATIONS**

In addition to the population surveys, the Department has run a winter crab tagging project through the ice near Nome from 1983 through 1993 (Appendix Table The winter crab studies began as an index of near shore crab abundance during the season of heaviest local subsistence use. Today some of the controversy of mining impacts on crab distribution has taken the place of previous controversy over commercial versus subsistence use of the resource. From the perspective of the local management biologist this documentation of crab abundance is important because it was the most objective comparison of crab availability to local people. Controversy over this preferred subsistence personal use resource is likely to continue in the future especially if winter crab harvests decline even for a short time. Unfortunately, the winter project was not funded in 1992-93 due to budget cuts. The staff is currently working with past year's data to demonstrate how winter age/length data compares to summer commercial catch data.

The catch per pot lift has been high in the winter study since the 1990 season when the CPUE increased to roughly twice the 1987 and 1989 levels. The 1992-93 winter study found it difficult to find crab possibly due to the 1992 fall storm. The crab that were observed consisted of lower than average compositions of recruit and sublegal animals (Appendix Table E6). Currently, there is talk of discontinuing the NMFS triennial trawl survey of Norton Sound. Without this information, it will be very difficult to determine whether the legal male crab population of Norton Sound is being exploited at a level which will allow the population to stabilize and rebuild. The Department has relied on age data

collected during both the summer fishery and the winter study to track recruitment during the intervals between surveys since they each sample different portions of the population.

### 1994 OUTLOOK

A conservative quota of 340,000 pounds has been set for the Norton Sound Section during the 1994 season. The red king crab population is estimated to be less than 1/3 of the historic population. The population level has increased only slightly since 1985 even without a summer commercial fishery during 1991. A 340,000 pound harvest equates to roughly a 10% exploitation level. It is hoped that this rate of exploitation will allow the crab population to recover and stabilize at a higher level.

Table 19. Commercial harvest of red king crab from Norton Sound Section by statistical area, Northern Bering Sea District, 1993 (summer fishery only).

Statistical Area	# Vessels	Total H Number	larvest Pounds	Total Pots Lifted	Average Crab/Pot	Average Weight	
636401	1	476	1,373	55	8.7	2.88	
646401	3	653	1,963	120	5.4	3.01	
646402	1	214	730	26	8.2	3.41	
656330	1	85	265	25	3.4	3.12	
656401	16	35,711	105,341	2,276	15.7	2.95	
656402	15	67,516	193,079	3,920	17.2	2.86	
666330	6	10,854	31,758	545	19.9	2.93	
666401	1	174	746	9	19.3	4.29	
666402	1	230	535	87	2.6	2.33	
Totals		115,913	335,790	7,063	16.4	2.90	

Table 20. Winter subsistence red king crab catches and effort by gear type, Nome area, Norton Sound Section, 1992–1993.

Gear Type	Number of Fishermen	# Males Caught	# Males Kept	# Females Caught	# Females Kept	Total Crab Captured	Total Crab Kept
Pots	24	896	865	69	6	965	871
Handlines	1	15	15	0	0	15	15
Both	1	46	46	1	1	47	47
Unknown	11	156	154	10	10	166	164
Totals	37	1,113	1,080	80	17	1,193	1,097

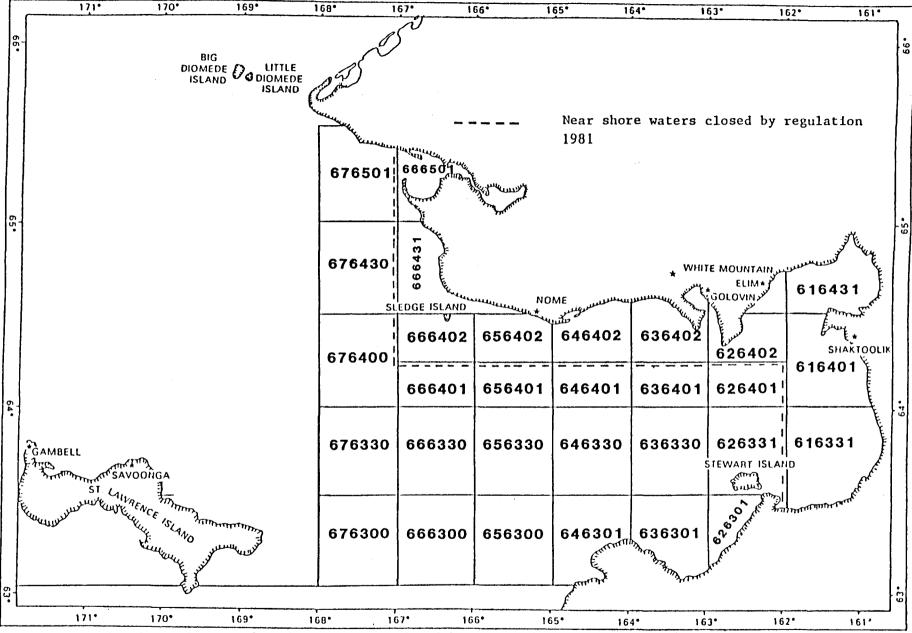


Figure 15. Statistical areas for the Norton Sound red king crab fishery.

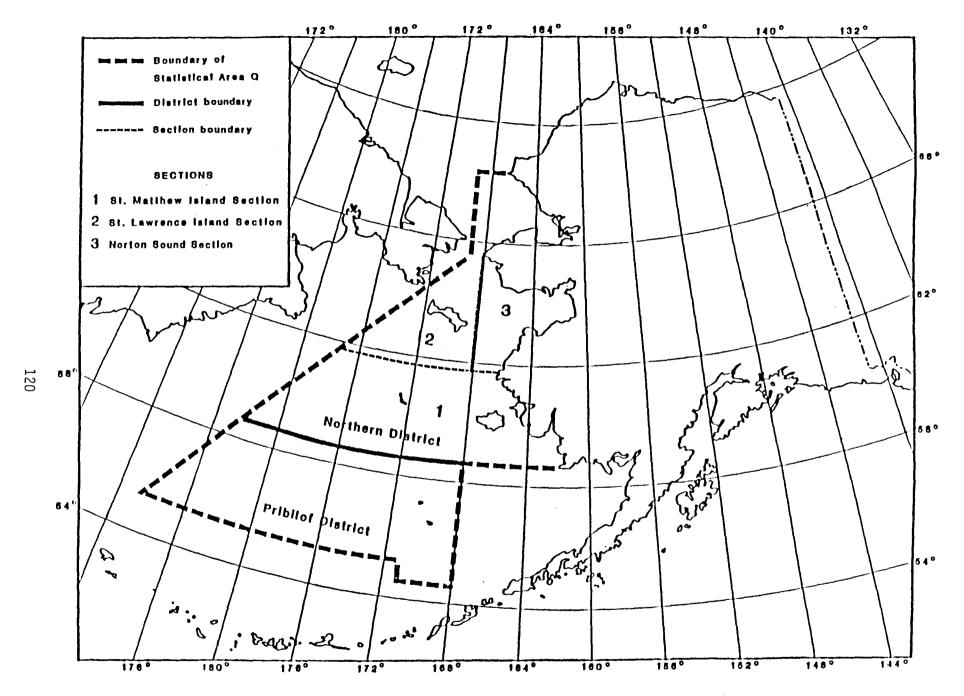


Figure 16. King crab fishing districts and sections of Statistical Area Q

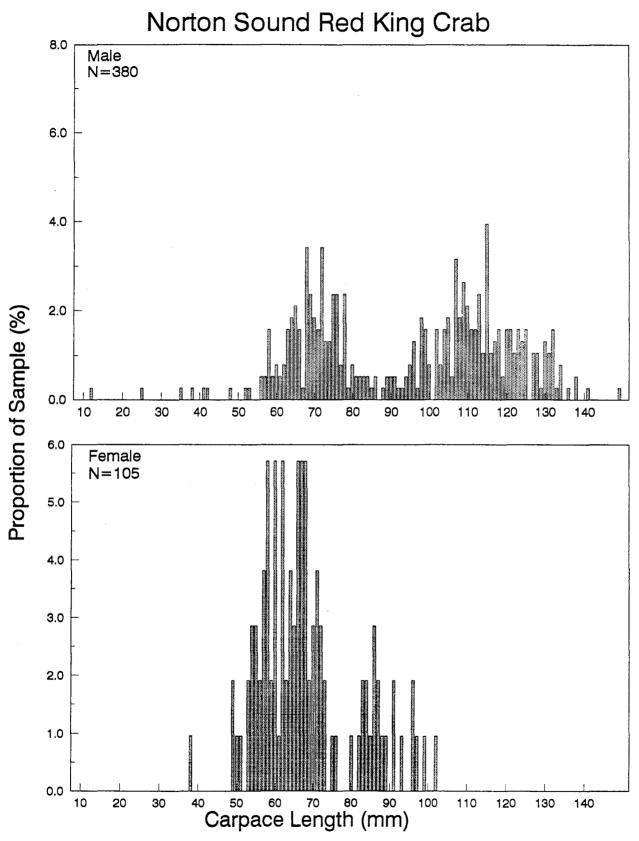


Figure 17. Norton Sound male and female red king crab size distribution from a trawl assessment survey conducted by the National Marine Fisheries Service, 1991.

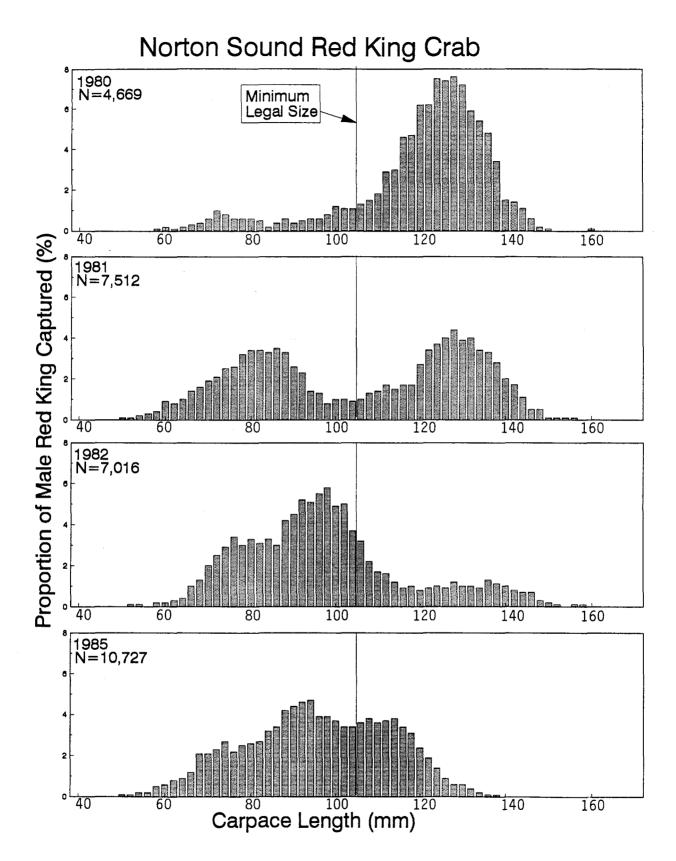


Figure 1 & Norton Sound male red king crab size distribution from pot assessment surveys conducted by the Alaska Department of Fish and Game, 1980, 1981, 1982, and 1985.

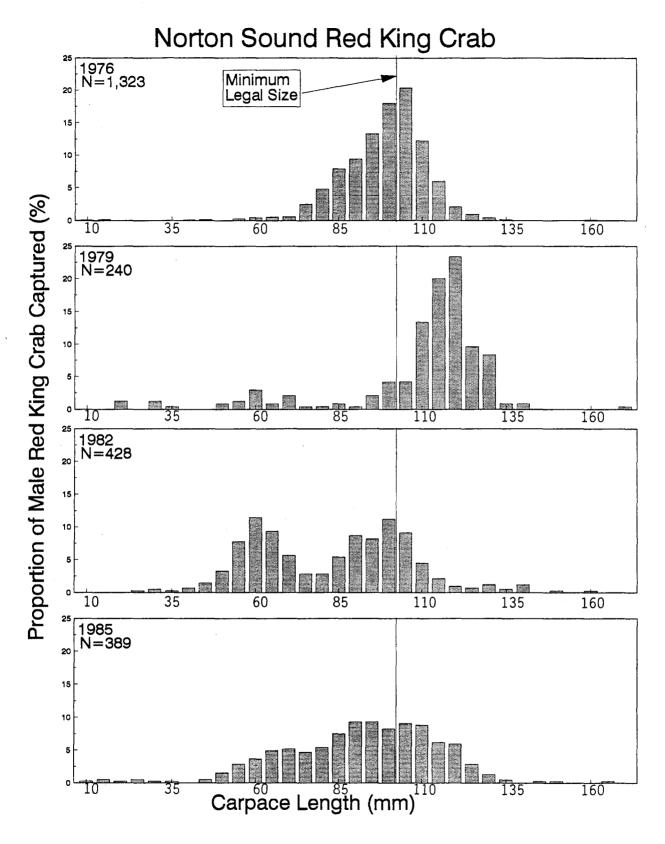


Figure 19. Norton Sound male red king crab size distribution from trawl assessment surveys conducted by the National Marine Fisheries Service, 1976, 1979, 1982, 1985, 1988, and 1991.

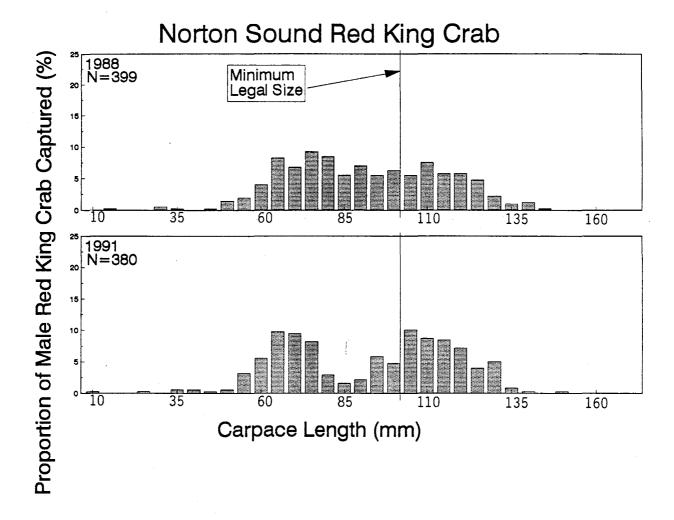


Figure 19. (Page 2 of 2)

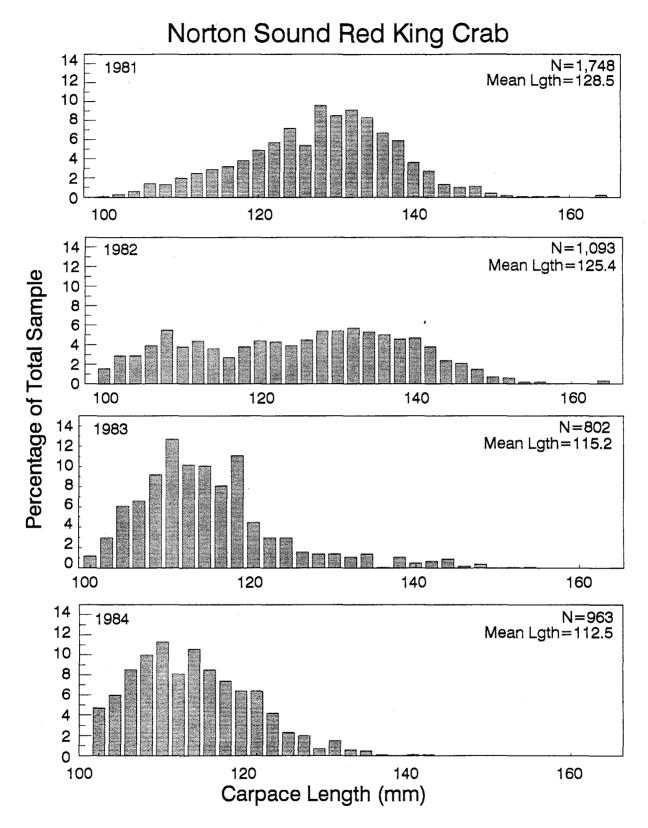


Figure 20. Norton Sound red king crab summer commercial catch samples, 1981-1993 (There was no commercial fishery in 1991).

# Norton Sound Red King Crab

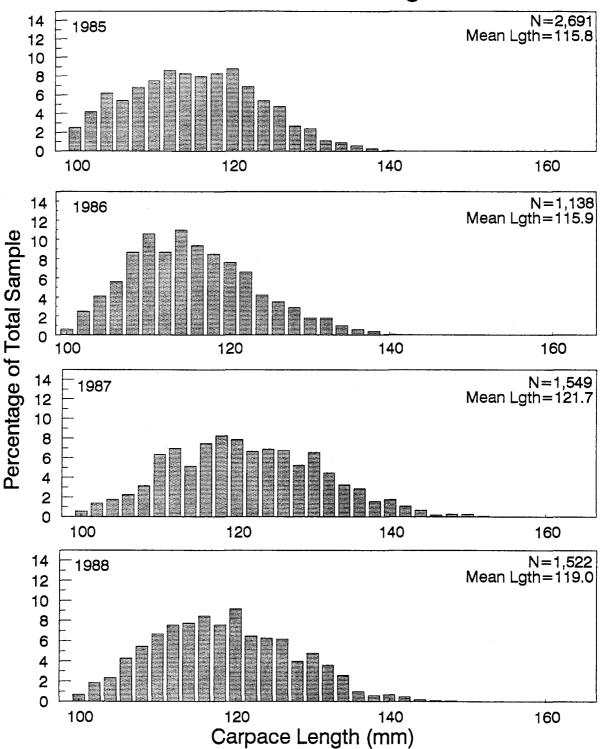


Figure 20. (page 2 of 3)

# Norton Sound Red King Crab

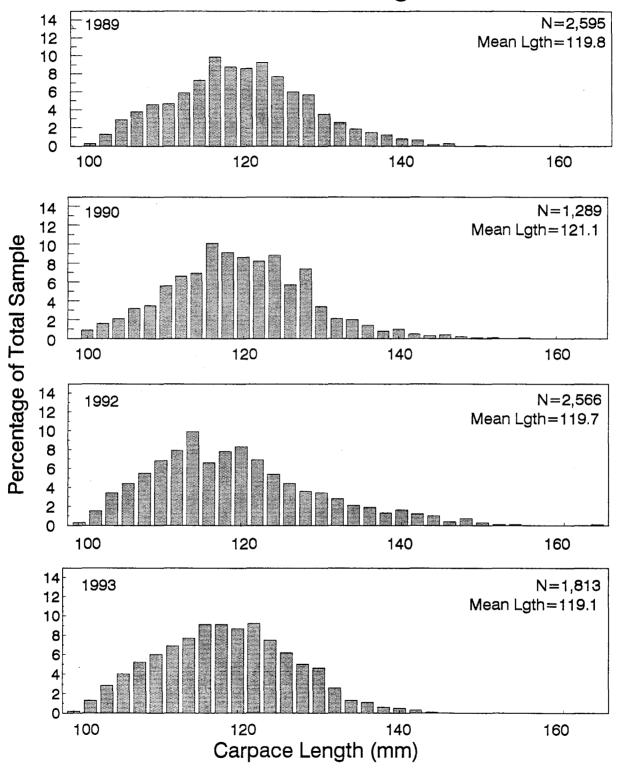


Figure 20. (page 3 of 3)

Appendix Table E1. Comparison of annual summer commercial harvest of red king crab from Norton Sound, Alaska by statistical areas, 1977-1993 (catch in pounds).

Statistical Area	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1992	1993	Totals
656402	306,302	90,187	288,869	918	3,098	2,832	· · · · · · · · · · · · · · · · · · ·		132,363							193,079	1,017,648
646402 626402	80,969 38,995		- ,		•	748			,							730	82,447 38,995
656401	55,555		138,011	121,147	253,387	60,480	11,422	183,119	246,200		194,408	185,644	100,956	171	53,119	105,341	1,633,405
646401			155,972	,	1,319	17,532	,	,	2.0,200		,	,	,		,	1,963	176,786
636401			100,012	12,398	61,823	32,246	5,880	41	891				22,030		1.159	1,373	137.841
626401	31,572			4,830	399	,	-,		-				,		.,	.,	36,801
656330			323,518	72,735	395,662	3,983	24,246	83,479	7,632		79,006	36,129	1,757		4,814	265	1,033,226
646330			•		4,716	-,			•		•	•	5,212				9,928
626331	40,020				·	22											40,042
616331	7,893																7,893
656300	•		161,699		15,174												176,873
666431			146,029														146,029
676501					36												36
666402	12,036	515,778	534,938	183,581		17,585			32,992							535	1,297,445
676430	•	3,811	12,309	-0-	373	3,513			1,171								21,177
666401		179,212	486,947	205,400	381,510	79,580	325,045	116,254	5,341	408,848	50,744	21,895	115,257	162,263	10,632	746	2,549,674
676400		667,130	33,856	274	92,026	1,315	247		32					3,212			798,092
666330		353,016	505,050	367,446	141,513	8,990	1,192		389	70,615	2,963	13,020	1,275	27,185	4,305	31,758	1,528,717
676330		51,304	81,798	6,762	18,734	-0-											158,598
686330			1,860		•												1,860
666300		162,795	60,816	84,874	9,167	95		4,534									322,281
676300		13,238		126,231													139,469
666230		55,490			77												55,567
Totals	517,787	2,091,961	2,931,672	1,186,596	1,379,014	228,921	368,032	387,427	427,011	479,463	327,121	236,688	246,487	192,831	74,029	335,790	11,410,830

<sup>\*</sup> No commercial fishery occured in 1991.

Appendix Table E2. Percent recruit and postrecruit size male red king crab from commercial catch samples by by year, Norton Sound Section, Bering Sea.

Year	Recruits <sup>a</sup>	Postrecruits <sup>b</sup>		
1977	53	47		
1978	29	71		
1979	33	67		
1980	15	85		
1981	10	90		
1982	27	73		
1983	55	45		
1984	59	41		
1985	45	55		
1986	49	51		
1987	22	78		
1988	25	75		
1989	23	77		
1990	21	79		
1991 °	_	_		
1992	28	72		
1993	31	69		

<sup>&</sup>lt;sup>a</sup> Percent Recruits = All new shell, legal size, male king crab of carapace length <116mm.

<sup>&</sup>lt;sup>b</sup> Percent Postrecruits = All other, legal size, male king crab.

<sup>°</sup> No Summer Commercial Fishery in 1991.

Appendix Table E3. Summer commercial red king crab harvest, Norton Sound, Bering Sea, 1976-1993.

Year	Legal Male Pop. Est.ª	Commercial Harvest <sup>b</sup>	Number of Vessels	Crab per Pot	Ave Wt per Crab(lb)	Exvessel Price / lb.	Fishery Value (millions \$
1976 <sup>c&amp;d</sup>	8.1			_	_		
1977 <sup>e</sup>	10.0	0.52	7	36	2.7	0.75	0.229
1978 <sup>e</sup>	11.0	2.09	8	64	3.0	0.95	1.897
1979 <sup>d</sup>	5.4	2.93	34	28	3.0	0.75	1.878
1980	6.6	1.19	9	29	3.6	0.75	0.890
1981	4.7	1.38	36	11	3.7	0.85	1.172
1982	1.3	0.23	11	6	3.6	2.00	0.405
1983	2.1	0.37	23	12	2.8	1.50	0.537
1984	2.7	0.39	8	14	2.8	1.02	0.395
1985	2.4	0.43	6	11	2.9	1.00	0.427
1986 <sup>f</sup>	2.8	0.48	3	38	2.9	1.25	0.600
1987 <sup>g</sup>	2.2	0.33	9	10	3.2	1.50	0.491
1988 <sup>h</sup>	3.2	0.24	2	32	3.1	i	
1989	3.2	0.25	10	15	3.1	3.00	0.739
1990 <sup>h</sup>	3.2	0.19	4	19	3.1	i	•
1991 <sup>c&amp;d</sup>	3.4		_	_	_	_	_
1992 <sup>d</sup>	3.4	0.07	27	. 4	3.0	1.75	0.130
1993 <sup>d</sup>	3.4	0.33	20	16	2.9	1.28	0.429

<sup>&</sup>lt;sup>a</sup> Population estimate prior to fishery in given year in millions of pounds.

<sup>&</sup>lt;sup>b</sup> Millions of pounds.

<sup>&</sup>lt;sup>c</sup> No summer commercial fishery.

<sup>&</sup>lt;sup>d</sup> Population estimate derived by National Marine Fisheries Service.

<sup>&</sup>lt;sup>e</sup> Population estimate derived from commercial harvest data.

<sup>&</sup>lt;sup>f</sup> Population derived from 1985 ADF&G pot study.

<sup>&</sup>lt;sup>g</sup> Population estimate based on 1985 assessment survey data and recruitment of current assessment data; estimate probably low due to lack of recent data.

<sup>&</sup>lt;sup>h</sup> Population estimate based on 1988 NMFS post season trawl survey combined with summer fishery harvest.

<sup>&</sup>lt;sup>1</sup> Data unavailable since all vessels were catcher/processors.

Appendix Table E4. Winter commercial and subsistence red king crab harvests, Norton Sound, Bering Sea, 1978–1993.

	COMMERC	CIAL	SUBSISTENCE								
Year <sup>a</sup>	Number of Fishermen	# Crab Harvested	Winter <sup>b</sup>	Permits Issued	Permits Returned	Permits Fished	Total Crab Captured <sup>c</sup>	Total Crab Harvested <sup>d</sup>	Average Harvest/fm		
1978	37	9,625	1977 –78	290	206	149	e	12,506	84		
1979	1	221	1978 -79	48	43	38	e	224	6		
1980	1	22	1979 -80	22	14	9	e	213	24		
1981	0	0	1980 -81	51	39	23	e	360	16		
1982	1	17	1981 -82	101	76	54	e	1,288	24		
1983	5	549	1982 -83	172	106	85	e	10,432	123		
1984	8	856	1983 -84	222	183	143	15,923	11,220	78		
1985	9	1,168	1984 -85	203	166	132	10,757	8,377	63		
1986	5	2,168	1985 -86	136	133	107	10,751	7,052	66		
1987	7	1,040	1986 -87	138	134	98	7,406	5,772	59		
1988	10	425	1987 -88	71	58	40	3,573	2,724	68		
1989	5	403	1988 -89	139	115	94	7,945	6,126	65		
1990	13	3,626	1989 -90	136	118	107	16,635	12,152	114		
1991	11	3,800	1990 -91	119	104	79	9,295	7,366	93		
1992	13	7,478	1991 -92	158	149	105	15,051	11,736	112		
1993	8	1,788	1992 -93	88	79	37	1,193	1,097	30		

<sup>&</sup>lt;sup>a</sup> Prior to 1985 the winter commercial fishery occured from January 1 thru April 30; as of March 1985, the winter commercial season was is open by regulation from November 15 thru May 15.
<sup>b</sup> The winter subsistence fishery occurs during months of two calendar years (as early as December, thru May).
<sup>c</sup> The number of crab actually caught; some crab may have been released.
<sup>d</sup> The number of crab "Harvested" is the number of crab caught and kept.

<sup>&</sup>lt;sup>e</sup> Data unavailable.

Appendix Table E5. Results of the population assessment surveys conducted for red king crab in Norton Sound since 1976.

Number of Red King Crab Captureda

Population Estimates of Legal Male Crab<sup>c</sup>

								or Logur	Male Clab
Year	Date	Research Agency	Vessel	Gear Effort	Sublegal Males	Legal <sup>b</sup> Males	Females	Numbers	Pounds
1976	9/02 - 9/05 9/16 -10/07	NMFS	Miller- Freeman	Trawl 158 tows	768	555	180	3,119,800	8,111,480
1979	7/26 - 8/05	NMFS	Miller- Freeman	Trawl 71 tows	46	194	40	837,241	2,511,723
1980	7/04 - 7/14	ADF&G	Altair	Pots 397 lifts	443	3,290	158	1,900,000	6,600,000 <sup>d</sup>
1981	6/28 - 7/14	ADF&G	Altair	Pots 718 lifts	4,097	3,415	1,933	1,285,195	4,755,221
1982	7/06 - 7/20	ADF&G	Aleutian #1	Pots 689 lifts	5,019	2,001	424	353,273	1,271,783
1982	9/05 - 9/11	NMFS	Miller- Freeman	Trawl 50 tows	322	107	265	970,646	2,620,744
1985	7/01 - 7/14	ADF&G	Arctic Sea	Pots 642 lifts	6,086	4,645	181	907,579	2,414,644
1985	9/16 -10/01	NMFS	Argosy	Trawl 78 tows	266	163	151	1,203,000	3,369,000
1988	8/16 - 8/30	NMFS	Miller- Freeman	Trawl 82 tows	258	141	218	1,037,000	3,038,000
1991	8/22 - 8/30	NMFS	Ocean Hope	Trawl 53 tows	202	178	105	1,384,000	4,009,000

<sup>&</sup>lt;sup>a</sup> Number of crab captured on ADF&G surveys represent data standardized for a 24 hour soak.

b Legal male red king crab were defined as at least 106mm in carapace length for the 1976 NMFS survey; 105mm for the 1979 and 1985 NMFS survey; and at least 121mm in carapace width for all ADF&G surveys.

Population est. are valid for the date of the survey, ie either before or after the summer commercial fishery.

<sup>&</sup>lt;sup>d</sup> The 1980 estimate has been revised from the original estimate of 13.4 million pounds. The original estimate was thought inaccurate due to under-reporting of recovered tagged crab.

Appendix Table E6. Size composition by percent of red king crab from winter research pots near Nome, Norton Sound, Bering Sea, 1983–1993. <sup>a</sup>

		SUBLEGAL			LEGAL	
Year	Prerecruit Twos	Prerecruit Ones	Totals	Recruits	Post- Recruits	Totals
1983	26	38	64	26	10	36
1984	35	31	66	19	16	35
1985	25	45	70	20	10	30
1986	26	35	61	22	17	39
1987	13	31	44	11	45	56
1988 <sup>ь</sup>	_	-	·			_
1989	27	15	42	27	31	58
1990	16	33	49	25	26	51
1991	5	30	35	34	31	65
1992°	_	_			·	_
1993	3	9	12	17	71	88

Pre-recruit Ones = Sulegals greater than 89mm in carapace length.

Pre-recruit Twos = Sublegals smaller than 90mm in carapace length.

Legals = male king crab greater than 4 3/4" carapace width.

Recruits = Legal new shell crab smaller than 116mm in carapace length.

Post-recruits = all non-recruit legal males.

<sup>&</sup>lt;sup>a</sup> Sublegals = male crab less than 4 3/4" carapace width.

<sup>&</sup>lt;sup>b</sup> No data collected in 1988 due to poor ice conditions.

<sup>&</sup>lt;sup>c</sup> No winter crab research study in 1992.

SECTION 4: MISCELLANEOUS SPECIES (Includes Norton Sound, Port Clarence and Kotzebue Districts)

#### SECTION 4 - MISCELLANEOUS SPECIES

#### INTRODUCTION

Several species other than salmon, crab and herring are utilized for commercial and subsistence purposes in the Norton Sound, Port Clarence and Kotzebue Districts. Primary species include inconnu or "sheefish" (Stenodus leucichthys), whitefish (Coregonus laurettae, Coregonus pidschian, Coregonus sardinella, Coregonus nasus, and Prosopium cylindraceum). (Coregonus sp., Prosopium sp.), Dolly Varden (Salvelinus malma) and saffron cod (Eleginus gracilis).

The fish are taken by set gillnets, beach seines, "jigging" through the ice, and rod and reel. Subsistence catches taken during the summer months are normally air dried, while winter catches are stored frozen. Fish are utilized both for human consumption and for dog feed. Fish taken for commercial purposes are mainly sold locally, although some are shipped from the area.

Subsistence harvest of most species is not limited by regulation. Commercial harvest may be prohibited in some freshwater areas, but limited commercial endeavors are allowed in many areas under terms of a permit.

# INCONNU (Sheefish)

The distribution of inconnu includes the Kobuk-Selawik River drainages, and Hotham Inlet of Kotzebue Sound and some Norton Sound drainages, but the largest populations and harvests occur within the former area (Figure 21). In the Kotzebue Sound area, adult fish migrate to upriver spawning areas after ice breakup and to wintering areas within the Hotham Inlet/Selawik Lake area during October-November. Although inconnu are capable of consecutive spawning, most fish spawn every two to three years. Inconnu mature slowly with males reaching maturity at 5-7 years of age and females at 7-11 years.

The inconnu's spawning and overwintering migration behavior makes them available for harvest by the various fisheries throughout their life cycle, and increases their vulnerability to overharvest. In addition, the inconnu's slow maturation rate increases the time required to restore depleted populations.

During the 1960's, age, sex and length data indicated stocks were being overharvested by the commercial and subsistence fisheries in the Kotzebue district. Consequently, an annual area commercial harvest quota of 25,000 pounds of inconnu was instituted, although subsistence catches remained unrestricted.

# Commercial Fishery

Most of the commercial fishing effort occurs near Kotzebue in Hotham Inlet. Fishermen use gillnets ranging from  $5\ 1/2$  inch - 7 inch stretched mesh which are set under the ice. Recorded commercial catches have remained relatively small; however, undocumented catches are believed to be significant and therefore, har-

vest totals should be considered minimum estimates. Restricted markets outside northwestern Alaska limits commercial activity greatly and most individuals who normally participate in the winter commercial fishery also fish for subsistence purposes. During some years, incidentally caught inconnu are also sold by commercial salmon fishermen when there is a market, but only in small amounts.

The commercial sheefish catch for 1992-1993 was taken by 1 permit holder and totaled 210 fish (Appendix Table F1). The total weight was 1,700 pounds that averaged 8.1 pounds per fish. The average price per pound was \$.50 for a total fishery value of \$85.

## Subsistence Fishery

Inconnu have long been utilized for subsistence purposes throughout the Kotzebue Basin. Fishermen along the upper Kobuk River fish for inconnu during June through October, while the lower Kobuk and Selawik River residents fish during April through June. Kotzebue and Selawik fishermen fish in the Hotham Inlet and Selawik Lake during the winter months.

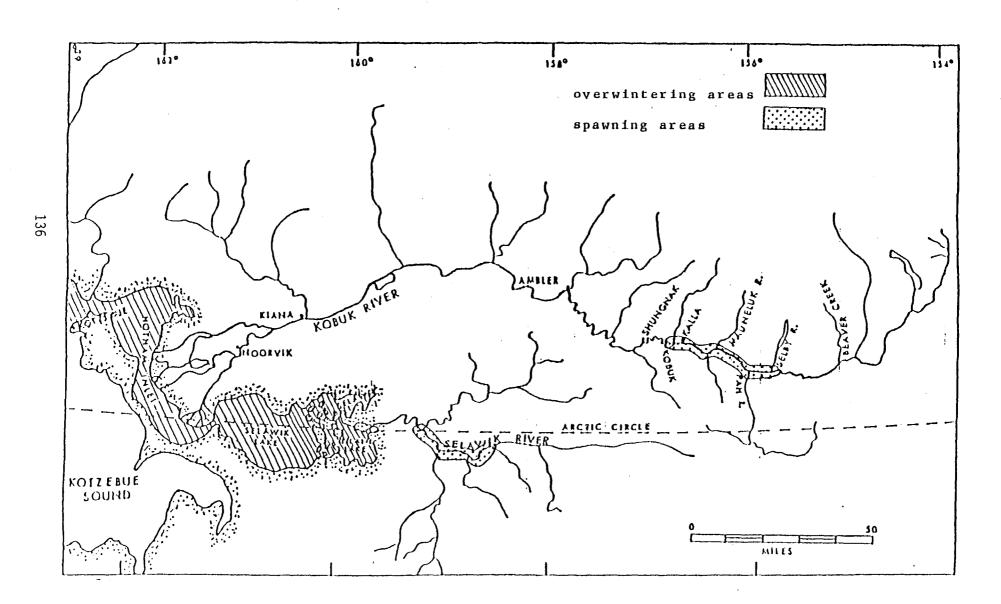
The 1993 winter subsistence harvests of inconnu in Kotzebue Sound and Selawik Lake was 2,441, 46 fishermen were interviewed, and the average catch per fisherman was 53. Historical reported catches are presented in Appendix Table F2.

During the fall of 1993, household interviews were conducted to document subsistence finfish catches, primarily salmon, by residents of the Kotzebue District. Household surveys were conducted in Shungnak, Noorvik, and Noatak. Other villages were not surveyed due to budget restrictions. Mail-in survey calendars were not distributed so subsistence harvest information should be considered very minimal. Few inconnu had been harvested at the time of the survey; many fishermen were still fishing.

## Escapement

In recent years aerial surveys have been conducted on key inconnu spawning areas incidental to the effort of enumerating salmon. These surveys have primarily been conducted along the upper Kobuk River in September. Survey conditions historically result in either very few or no inconnu being observed (Appendix Table F3). During these surveys, species identification has been a problem in some years. Surveys were not conducted in 1985 thru 1990 due to high, turbid water, poor weather conditions, or lack of personnel. (\*\*\* The 1991 season had unusually good surveying conditions and counted an unusually high number of inconnu in the Kobuk River.\*\*\*) Incomplete escapement and catch data provide little basis for assessing the current population status of inconnu in the Kotzebue district, however there is some local concern that the inconnu stocks are declining.

Figure 21. Kotzebue and Kobuk River Valley villages and their spatial relationship with Inconnu spawning and overwintering areas.



Appendix Table F.1. Kotzebue District winter commercial Sheefish harvest statistics, 1967 – 1993. <sup>a</sup>

		ounds	Po			
Estimate Valu	Price/ Pound	Average	Total	No. of Fish	No. of Fishermen	Year <sup>b</sup>
\$5,20	\$0.20	6.5	26,000	4,000		1967 °
\$1,04	\$0.22	6.0	4,752	792	10	1968
\$3,80	\$0.25	6.5	15,209	2,340	17	1969
Ψ0,00	\$0.23	0.5	15,265	2,206	17	1970 °
\$9	\$0.13	9.9	720	73	. 4	1971
фэ \$65	\$0.15 \$0.16	9.9 8.9	4,071	456	. <del> </del>	1971
\$3,12	\$0.10	6. <del>3</del>	15,604	2,322	11	1973
\$3,12 \$1,88	\$0.20	5.8	6,265	2,322 1,080 <sup>d</sup>	6	1973
\$1,00 \$7,24	\$0.30 \$0.30	9.5	24,161	2,543 <sup>d</sup>	c	1974
\$7,24 \$5,84	\$0.30 \$0.30	9.5 7.4	19,484	2,543 2,633	14	1975
	\$0.30 \$0.30	8.8	5,004	2,633 566	2	1977
\$1,50 \$10.48			26,200	2,879	11	1977
\$10,48	\$0.40	9.1	26,200	2,079	1.1	
***	<b>#0.50</b>	7.0	0.005	4 475		1979 °
\$4,11	\$0.50	7.0	8,225	1,175	4	1980
\$1,37	\$0.75	6.6	1,836	278	1	1981
\$13,03	\$0.75	6.6	17,376	2,629 <sup>f</sup>	11	1982
\$6,69	\$0.50	9.4	13,395	1,424	8	1983
\$5,72	\$0.55	11.2	10,403	927 <sup>d</sup>	5	1984
\$1,99	\$0.51	11.4	3,902	342 <sup>d</sup>	4	1985
\$23	\$0.75	12.0	312	26	2	1986
\$2,65	\$0.49	8.1	5,414	670	3	1987
\$3,31	\$0.45	7.8	7,373	943	3	1988
\$8,54	\$0.51	7.2	16,749	2,335	8	1989
		8.2	5,617	687	6	1990 °
\$4,11	\$0.50	9.7	8,224	852	5	1991
\$1,85	\$0.65	9.9	2,850	289	3	1992
\$85	\$0.50	8.1	1,700	210 <sup>đ</sup>	1	1993

<sup>&</sup>lt;sup>a</sup> Data is not exact, in some instances total catch poundage was determined from average weight and catch data. Similarly, various price/pound figures were determined from price/fish and average weight data.

<sup>&</sup>lt;sup>b</sup> Season was from October 1 to September 30. Year indicated would be the year the commercial season ended. For example, the year 1980 would represent October 1, 1979 to September 30, 1980.

<sup>&</sup>lt;sup>c</sup> Data unavailable or incomplete.

<sup>&</sup>lt;sup>d</sup> Number of fish not always reported. Estimates were based on average weight from reported sales which documented the number of fish.

<sup>&</sup>lt;sup>e</sup> No reported commercial catches.

<sup>&</sup>lt;sup>f</sup> Estimate based on historical average weight.

Appendix Table F2.

Reported subsistence inconnu catches, Kotzebue District, 1966–1993. a,d

	Number of		Average
	Fishermen	Reported	Catch per
Year	Interviewed	Harvest	Fishermen
1001	IIICIVICU	11014031	1 101101111011
196667	135	22,400	166
1967-68	146	31,293	214
1968-69	144	11,872	82
1970	168	13,928	83
1971	155	13,583	88
1972	79	3,832	49
1973	65	4,883	75
1974	58	1,062	18
1975	69	1,637	24
1976	57	966	17
1977	95	1,810	19
1978	95	1,810	19
1979	75	3,985	<b>`</b> 53
1980	74	3,117	42
1981	62	6,651	107
5/82-4/83 <sup>b,c</sup>	130	4,704	36
5/83-4/84 <sup>b,c</sup>	27	764	28
5/84-9/84 <sup>b</sup>	30	2,803	93
1985 °	2	60	30
1986 <sup>c,e</sup>	72	721	10
1987 <sup>e</sup>	46	276	6
1988 <sup>e,f</sup>	_	_	
1989 <sup>e</sup>	_	_	_
1990 °	_	_	<u>-</u>
1991	40	2,180	55
1992	43	2,821	66
1993	46	2,441	53

<sup>&</sup>lt;sup>a</sup> To obtain individual village catches during years previous to 1982 refer to the 1982 Annual Management Report.

<sup>&</sup>lt;sup>b</sup> Catch by village for these years are presented in separate tables in respective year annual management reports.

<sup>&</sup>lt;sup>c</sup> Summer catches only; winter catches were not documented.

<sup>&</sup>lt;sup>d</sup> Due to limited survey effort during many years, total catch an effort should be regarded as minimum figures only and are not comparable year to year.

Villages were not surveyed for subsistence inconnu harvests from 1985 to present; figures shown are catches reported during the fall chum salmon subsistence surveys, and may include summer as well as winter catches.

<sup>&</sup>lt;sup>f</sup> Subsistence inconnu catches not documented.

Appendix Table F3. Annual aerial survey counts of inconnu in the Kobuk and Selawik Rivers, 1966–1992.

	Kobuk	Selawik	
Date	River	River	Total
Date	nivei	Uivei	Total
09/05/66	1,200	b	1,200
09/22/67	1,025	ь	4,359
09/14/68	4,973	1,234	6,207
09/10/69	3,654	b	3,654
09/05/70	3,220	ь	3,220
08/30/71	8,166	1,196	9,362
08/22/72	a	ь	<del>_</del>
1973	ь	b	_
08/21/74	a	b	_
08/24/75	a	ь	_
09/02/76	73	ь	73
1978	b	ь	_
09/12/79	2,824	b	2,824
09/11/80	1,772	ь	1,772
09/15/81	250 °	b	250
1982	a	b	а
09/19/83	1,009 °	b	1,009
09/05/84	2,604	ь	2,604
1985	b	b	-
1986	b	ь	_
1987	b	ь	
1988	b	ь	_
1989	b	b	_
1990	b	ь	_
1991	17,335	ь	_
1992	3,310	b	_
1993	b	b	<del>-</del> _

a No fish reported.
 b Not surveyed.
 c Probably more inconnu than listed; species identification problems.

#### **DOLLY VARDEN**

#### Introduction

Dolly Varden (<u>Salvelinus malma</u>) are distributed throughout the Norton Sound, Port Clarence, and Kotzebue districts. Although taxonomists have disagreed on the distinguishing Dolly Varden characteristics and distribution of Arctic Char and Dolly Varden, most taxonomists now agree that char in this area are the northern form of Dolly Varden. In order to eliminate confusion, in this report these fish will be referred to as Dolly Varden, the common name for this species complex.

Dolly Varden in this area are primarily nonconsecutive spawners and spawn throughout the late summer and fall. Fry emerge in the spring and migrate to the ocean during early summer after spending from 1 to 6 (generally 2-5) years in freshwater. Since Dolly Varden are a late-maturing fish (generally age 6-7), they are susceptible to overfishing by commercial, subsistence, and/or sport fisheries. Consequently, commercial fisheries have been maintained at low levels or prohibited to both reduce the potential of overharvest and provide for reproductive and subsistence fishery needs.

## Commercial Fishery

Dolly Varden are taken incidentally to chum salmon in the Kotzebue commercial fishery (Tables 10 and 11). Regulation changes in 1976, which closed the commercial salmon fishery on August 31, have reduced the harvest of Dolly Varden since in most years Dolly Varden are primarily available for harvest during September. Dolly Varden generally appear in commercial catches during the last three weeks of August (Table 21). Reported Dolly Varden catches are dependent upon available markets. The typical season catch when buyers are purchasing Dolly Varden is between 1,000 to 3,000 fish (Appendix Table F4). In 1993, 76 Dolly Varden were caught and sold during the commercial salmon fishery. The total weight was 540 pounds for a 7.1 pound averaage per fish and the average price was \$0.10 per pound. (\*\*\*The 1991 harvest was significantly higher at 6,136 due to a high Dolly Varden return with a strong pulse of fish that moved through the commercial fishery during an open period.\*\*\*) Historically two-thirds of the catch is taken on the north side of the district near Sisaulik.

There are several small quota (2,500 pounds) freshwater fisheries in Norton Sound but effort is inconsistent, varying from year to year and stream to stream. Fishermen often buy permits but seldom make commercial sales.

## Subsistence Fishery

Dolly Varden are an important component in the diet of subsistence users in the Norton Sound-Kotzebue Sound areas. Subsistence fishermen catch Dolly Varden with seines in the fall, hook and line through the ice in the winter, and gillnets in the spring. The fall seine fishery contributes the greatest number of fish to the annual subsistence Dolly Varden harvest. Since 1962, seine catches made by

the residents of Kivalina, within the Kotzebue District, have ranged from 7,000 to 49,000 Dolly Varden annually (Appendix Table F5)

Fall seine fishing is a group effort with several households comprising a fishing group. The catch is stored and allowed to freeze in willow cribs located near the seining site. These fish are used throughout the winter by the fishing group (DeCicco 1985). It should be pointed out that the historical subsistence Dolly Varden catches that are summarized in Appendix Table F5 are very minimal figures due to the timing of the surveys conducted. Most Dolly Varden harvest take place prior to or just after freeze-up. The village of Noatak usually fishes prior to freeze-up, while the Kobuk River villages of Shungnak and Noorvik fish for Dolly Varden throughout the winter.

Most villagers in the Norton Sound District report incidental catches of Dolly Varden in their subsistence salmon nets. However, the bulk of the catch is taken by seining in the late fall, after Department subsistence surveys had been completed which made it difficult to estimate subsistence catches in the Norton Sound District. Due to budget restrictions, no subsistence surveys were conducted in the fishing villages of Norton Sound since 1985.

# Sport Fishery

Residents of the Kotzebue area and nonlocal residents on wilderness boating trips on the Kobuk and Noatak Rivers are the primary participants in the Dolly Varden sport fishery in the Kotzebue area watershed. Approximately 1,500 Dolly Varden are taken in this fishery annually (Sport Fish Division surveys).

## Overwintering Counts

Aerial survey counts of overwintering Dolly Varden on the Wulik River have ranged from 297,257 Dolly Varden in 1969 to 30,923 Dolly Varden in 1984 (Appendix Table F6). Weather and water conditions have precluded flying aerial surveys during many years. When weather permits, the Division of Sport Fisheries conduct aerial surveys of the spawning grounds on the Noatak River in the summer and the overwintering areas of the Kivalina and Wulik Rivers in the fall. During the fall of 1993, 144,000 overwintering Dolly Varden were counted on a survey of the Wulik River (Sport Fish Division survey). The 1993 survey was the second highest ever documented for the Wulik River. Additional surveys were conducted on the Noatak and Kivalina Rivers.

Table 21. Incidental Dolly Varden catches in the Kotzebue District commercial salmon fishery by fishing period, 1993.

		Hours	Number of		Dolly Varden			
Period	Dates	Fished	Fishermen	Number	Pounds	Avg. Wt.		
9	8/05-8/06	24	88	76	540	7.1		
Totals		24		76	540	7.1		

Appendix Table F4.

Dolly Varden harvested incidentally during the commercial salmon fishery, Kotzebue District, 1966-1993.

	Number			Average	Average
	of Fish	Estimated	Pounds	Weight	Price per
Year	Sold	Total Catch <sup>g</sup>	Sold	Pounds	Pound
					6
1966	3,325			7-10	0.55 <sup>f</sup>
1967	367		2,606	7.1	0.11
1968	3,181	•	21,949	6.9	0.14
1969	1,089 a		_	_	2.84 <sup>f</sup>
1970	2,095		_		-
1971	3,828 <sup>b</sup>		23,353	6.4	0.16
1972	7,746		56,545	7.3	0.17
1973	640		4,608	7.2	0.16
1974	2,605 °		20,580	7.9	0.16
1975	_		_	_	_
1976	_		_	_	_
1977	_		_	_	_
1978	1,229		9,094	7.4	0.15
1979	2,523		12,523	5.0	0.25
1980	3,049		17,015	5.6	0.20
1981	3 °		16	5.6	0.17
1982	3,447		23,648	6.9	0.20
1983	<sup>1</sup> 190 <sup>¢</sup>	845	1,108	5.8	0.20
1984	347 <sup>e</sup>	1,090	2,104	6.1	0.25
1985	454	3,600	3,177	7.0	0.25
1986	.5 °	2,373	<sup>′</sup> 34	6.8	0.20
1987	1,261	h	8,704	6.9	0.30
1988	752	h	4,967	6.6	0.35
1989	3,093	h	20,293	6.6	_
1990	604	h	4,219	7.0	0.25
1991	6,136	h	40,747	6.6	0.18
1992	1,977	h	11,951	6.1	0.10
1993	76	h	540	7.1	0.10

a Includes 269 taken by permit.
 b Includes 179 taken by permit.
 c Includes 234 taken during commercial inconnu fishery.

<sup>&</sup>lt;sup>d</sup> Some data extrapolated from average reported weight.

<sup>&</sup>lt;sup>e</sup> Limited char market; many fish used at home or dumped.

f Price per fish.

g Estimate includes fish caught but not sold based on interview of fishermen.

<sup>&</sup>lt;sup>h</sup> Estimate of char caught (but not sold) not made.

Appendix Table F5. Fall subsistence catches of Dolly Varden documented in Kivalina and Noatak, 1959–1993.

	Kival	ina	Noatak
Year	Number	Pounds	Number <sup>d</sup>
1959 ª	34,240	85,600	
1960 ª		•	_
1962	49,720	124,300	07 600
	_	_	27,623
1963	-	-	4,130
1968	49,512	120,214	_
1969	64,970	152,750	32,350
1970	33,820	79,420	3,700
1971	29,281	68,518	5,320
1972	48,807	114,637	1,492
1973 <sup>b</sup>	_	· <del></del>	<del>-</del>
1979	14,600 °	_	9,060
1980	· _	_	7,220
1981	15,000-18,000°	_	3,056
1982	18,438 <sup>e</sup>	_	2,676 b,f
1983	16,270 °		4,545
1984	12,000 °	<del>_</del>	2,542
1985	10,500 °	_	
1986	7,436 °	_	46 <sup>h</sup>
1987	g	_	1,376 <sup>h</sup>
1988	· <b>g</b>	_	1,070 g
1989	g		g
1990	g	_	g
1991	g	<del>-</del>	
	g	<del></del>	4,814
1992	g	_	4,395
1993	<b>6</b>		4,275

<sup>&</sup>lt;sup>a</sup> From Saario, Doris J. and Brian Kessel, Environment of Cape Thompson Region, Alaska, published by the U.S. Atomic Energy Commission, 1966.

<sup>&</sup>lt;sup>b</sup> Storm and ice conditions prevented fall harvest.

<sup>&</sup>lt;sup>c</sup> Harvest data from Sport Fish Division survey.

<sup>&</sup>lt;sup>d</sup> No data available on poundage.

<sup>&</sup>lt;sup>c</sup> Harvest data from Stephen Braund and Associates.

<sup>&</sup>lt;sup>f</sup> Expanded estimate (see text on subsistence fishery in 1982 Annual Management Report).

<sup>&</sup>lt;sup>g</sup> Not surveyed.

<sup>&</sup>lt;sup>h</sup> Subsistence fishermen just beginning to seine at time of the survey.

Appendix Table F6. Aerial survey counts of overwintering Dolly Varden and summer spawner surveys in the Kotzebue District watershed, 1968–1993.

	Noatak River	Over	wintering
	Spawner	Wulik	Kivalina
Year	Survey <sup>a</sup>	River <sup>b,e</sup>	River <sup>b,e</sup>
1968	_	90236	27640
1969 <sup>b</sup>	_	297257	_
1976	_	68300	12600
1977 <sup>d</sup>		_	_
1978 <sup>d</sup>	_	<b>-</b>	
1979	, <b>–</b>	55030	15744
1980	_	113553	39692
1981	7922	101826	45355
1982	8275	65581	10932
1983	2924 °	d	d
1984	9130	30923	5474
1985	10979	-	_
1986	f	5590	5030
1987	f	f	f
1988	f	80000 °	f
1989	f	56384	f
1990	7261	t .	t
1991	9605	126985	35275
1992	f	135135	` d
1993	9560	144138	16534

<sup>&</sup>lt;sup>a</sup> Includes spawner count on the Kelly, Kugururok and Nimiuktuk Rivers, tributaries of the Noatak.

b Overwintering counts conducted in September.
c Incomplete survey.
d Poor weather hampered/prevented survey.

<sup>\*</sup> Surveys conducted by Sport Fish Division since 1979.

f Not surveyed.

#### WHITEFISH

#### Introduction

Although inconnu belong to the whitefish family, this section deals with several smaller species of the genera <u>Coregonus</u> and <u>Prosopium</u>. The genus <u>Coregonus</u> contains the "broad" and "humpback" whitefish or <u>C</u>. <u>nasus</u> and <u>C</u>. <u>pidschian</u>, respectively. In addition, three whitefish species known as "ciscoes" belong to this genera; ie., the least cisco ( $\underline{C}$ . <u>sardinella</u>), Arctic cisco ( $\underline{C}$ . <u>autumnalis</u>) and Bering cisco ( $\underline{C}$ . <u>laurettae</u>). "Round" whitefish (<u>Prosopium cylindraceus</u>) are the sole representatives of the genus Prosopium in this area. All species normally spawn in the fall in freshwater.

Whitefish occur throughout most bodies of freshwater in the Norton Sound/Port Clarence/Kotzebue areas and can also be found in inshore marine waters at various times of the year.

Whitefish are harvested to a very limited extent by the commercial and sport fisheries within the area, but are uniformly important to the various subsistence fisheries. Recently, there has been increasing interest in commercial development of this resource, especially in the Kotzebue district.

## Commercial Fishery

Limited commercial whitefish harvests have been allowed since statehood, normally under the auspices of a permit which delineated harvest levels, open areas, legal gear, etc. Commercial whitefish fisheries have generally been limited to large open water areas (e.g. Grantley Harbor in the Port Clarence district) or ocean waters. Beach seines have been stipulated as legal gear in some instances in order to reduce the number of incidental species taken. Little comparative commercial catch and effort data have been recorded, but harvest levels have historically been low. A majority of the commercial catches have been made in Golovin Bay within the Norton Sound District, in the Kuzitrin River of the Port Clarence District, and in Hotham Inlet and Selawik River in the Kotzebue District. The fish have been sold to local markets for human consumption, dog food, or more recently, crab bait.

In the Kotzebue District, a permit to harvest up to 15,000 pounds of whitefish and 3,000 pounds each of pike and burbot was issued to Selawik Fish Project in 1986. The season extends from April to December. Fish sold during June and July of 1986 were purchased as dried fish with an assumed fresh weight of 3 pounds per whitefish (primarily broad and humpback whitefish). A total of 616 whitefish (1,848) pounds were landed by beach seine and gillnet. Fishermen received \$11 per string of 8 whitefish. Nine permit holders participated in this fishery. Burbot and pike sales were also reported from the Kotzebue District, but will be discussed in the Miscellaneous Finfish Species section. The Selawik whitefish project only operated during the 1984 thru 1987 seasons. In 1989 three fisherman from Kotzebue reported sales totalling 470 pounds of whitefish.

# Subsistence Fishery

Whitefish have been taken mainly by beach seine or set gillnets. Catches are usually dried and used for human consumption or dog food. In some areas fish are "gutted" and dried early in the summer, while later in the summer the fish are filleted and dried with the eggs and viserca intact.

Subsistence catch enumeration is difficult since fishermen do not count fish individually, but by "tubs", "bags", "strings" or any other estimators of gross abundance. Additionally, many fish have been dried and consumed or stored in caches prior to the survey period. Reported subsistence harvests are the result of a limited and sporadic survey effort and should be regarded as minimum figures and not comparable from year to year. Recent and historical subsistence harvest figures for the Kotzebue district are presented in Appendix Table F7 by year.

# Escapement

Whitefish escapements have not been monitored in the past, but there have been no indications from limited Department observations or fishermen interviews of declining populations.

Appendix Table F7.

Subsistence whitefish catch and effort data, Kotzebue District, 1970–1993.<sup>a</sup>

	Fishermen	Number	—
.,	Fishermen	Number	
Year	Interviewed	of Fish	
1970		58,165	
1971		36,012	
1974-1976	b	b	
1977 <sup>-</sup>		30,810	
1978		77,474	
1979	123	43,653	
1980	67	49,106	
1981	71	37,746	
1982	b	b	
1983	47	16,389	
1984	79	28,614	
1985 °	46	5,229	
1986 <sup>d</sup>	72	11,854	
1987 <sup>d</sup>	46	20,020	
1988 <sup>e</sup>	38	14,000	
1989	b	b	
1990	ь	ь	
1991 <sup>d</sup>	63	16,015	
1992 <sup>d</sup>	66	17,485	
1993 <sup>đ</sup>	70	19,060	

<sup>&</sup>lt;sup>a</sup> Data unavailable prior to 1970. Systematic whitefish catch surveys have never been conducted in the area. This information was collected incidentally with late summer salmon surveys and probably represents only a small fraction of the catch made on a year round basis.

<sup>&</sup>lt;sup>b</sup> Data unavailable.

<sup>&</sup>lt;sup>c</sup> Data was expanded based on limited interviews and represents the approximate harvest of fishermen contacted in Kianna and Shungnak only. These figures should be considered very minimal.

<sup>&</sup>lt;sup>d</sup> Data represents harvest reported from interviews of subsistence fishermen in Shungnak, Noorvik, and Noatak only. Since not all fishermen were contacted and fishing was still occurring at the time of the survey, these figures should be considered minimal.

<sup>&</sup>lt;sup>c</sup> Data represents harvest reported during fall chum subsistence surveys in Noorvik and Shungnak only; most families still fishing.

#### SAFFRON COD

Saffron cod, or tomcod as they are called locally, are extensively utilized as a subsistence resource in the Norton Sound, Port Clarence and Kotzebue Districts. Tomcod are taken through the ice by jigging as well as with gillnets in open water.

There has never been an extensive commercial fishery on tomcod in the Norton Sound, Port Clarence or Kotzebue areas. During 1980, one fisherman caught and sold 89 pounds (98 tomcod) in the Nome Subdistrict. There were no commercial landings during 1982. In 1983, one Nome area fisherman caught and sold 2,548 pounds (4,348 tomcod) and in 1989 one fisherman sold 1,800 pounds locally. These fish were used for dog food, crab bait and human consumption. No commercial deliveries were reported in during 1984-1988.

The Alaska Native Foundation undertook a feasibility study for the development of a dried saffron cod fishery in the Port Clarence/Shishmaref area in 1980. Samples taken to prospective buyers and various markets proved that an economically viable commercial fishery does not exist for this species in this area. If marketing conditions improve and if local residents are willing to participate in a labor intensive dried saffron cod fishery, a commercial fishery for saffron cod could develop.

#### MISCELLANEOUS FINFISH SPECIES

Other finfish species taken for subsistence in the Norton Sound-Port Clarence-Kotzebue area include: rainbow smelt (boreal smelt), capelin, northern pike, starry flounders, yellow fin sole, arctic flounder, Alaska plaice, grayling, burbot, Pacific herring in the Fall, and halibut (Appendix G1).

Subsistence utilization of these species has been documented although effort and catch vary widely in scale and importance with locality. Some of these species are important to the subsistence community in certain localities during specific seasons of the year.

Until 1984, sale of any of these species had never been documented in this area, although unreported sales had occurred. The City of Selawik Cooperative Whitefish Project was issued a permit allowing a harvest and sale of up to 1,000 pounds each of burbot and pike as an incidental part of their commercial harvest of whitefish. A total of 1,232 pounds of pike were reported sold locally as dried fish. An amendment to the existing permit was granted allowing up to 1,332 pounds of pike to be harvested so a shipment of an additional 100 pounds could be allowed for a frozen fish market test. No sales of burbot from the Selawik area were reported in 1984.

In 1985, the City of Selawik was issued a permit allowing a harvest of up to 3,000 pounds each of burbot and pike as an incidental part of their commercial whitefish harvest. The total reported harvest of burbot was 81 fish weighing 607 pounds for which the fishermen received \$.85 per pound. Pike were sold as fresh or dried fish. A total harvest of 1,228 pike was reported; 196 fish weighing 918 pounds were sold for \$.85 per pound; 1,031 pike were sold as dried fish for which

fishermen received \$12.00 per string of 6 fish (no weights given). The dollar value of the dried pike was thus \$2,064.00; the total dollar value of burbot and pike combined was \$3,360.00 during 1985.

In 1986, the City of Selawik was granted a permit to harvest 3,000 pounds each of pike and burbot. A total of 546 pike (approximately 4,368 pounds) were landed by beach seine and gillnet and sold. Fishermen received \$12 per string of 6 pike. An assumed weight of 8 pounds per pike was used since these fish were sold as dried fish. No burbot sales were reported. The City of Selawik terminated operations after the 1986 season.

Additionally, there were reported sales of 65 burbot (294 pounds) from the Noatak River in 1986 for \$.75 a pound and one fisherman from Port Clarence sold 600 pounds of Fall herring at \$.45 a pound.

No freshwater fishery permits for pike and burbot were requested in 1986 nor 1987 in the Norton Sound or Port Clarence districts. There is little information available on the population status and dynamics of many of these species, but there has been no evidence based on limited Department observations and interviews with fishermen, that any of these species are declining in numbers.

In 1993, one commercial fisherman reported selling 10,475 pounds of Fall bait herring at \$0.50 per pound. One other fisherman reported selling 148 halibut totalling 3,132 pounds from the Nome area.

Appendix G1. List of common and scientific names of finfish species of the Norton Sound-PortClarence-Kotzebue Districts.

> Arctic lamprey Lampetra japonica Arctic char Salvelinus alpinus Arctic cod Boreogadus saida Arctic flounder Liopsetta glacialis Arctic grayling Thymallus arcticus Alaska plaice

Pleuronectes quadrituberculatus

Burbot Lota lota leptura Bering cisco Coregonus laurettae Ocella dodecaedria Bering poacher Bering wolffish Anarhicas orientalis Blackfish Dallia pectoralis

Boreal smelt (rainbow-toothed)Osmerus epselanus Broad whitefish Coregonus nasus Mallotus villosus Capelin

Dolly Varden Salvelinus malma Pond smelt Hypomesus olidus Humpback whitefish Coregonus pidschian Stenodus leucichthys Inconnu (sheefish) Lake trout Salvelinus namaycush

Least cisco Coregonus sardinella Longhead dab Liranda proboscidea Ringtail snailfish Liparis rutteri Northern pike Esox lucius

Longnose sucker Catostomus Pricklebacks Stichaeidae Pacific herring

Clupea harengus pallasi Rock flounder Lepidosetta bilineata Rock greenling (terpug) Hexagrammus lagocephalus

Round whitefish Prosopium cylindraceum

Sculpins Cottidae

Pink salmon Oncorhynchus gorbuscha Chum salmon Oncorhynchus keta Coho salmon Oncorhynchus kisutch Sockeye salmon Oncorhynchus nerka

Chinook salmon Oncorhynchus tshawytscha

Saffron cod Eleginus gracilis Starry flounder Platichthys stellatus Sandlance Amrodytes hexapterus Agonus acipenserinus Sturgeon poacher

Gasterocteus aculeatus Threespine stickleback Ninespine stickleback Pungitius

Tubenose poacher Pallasina barbata aix Whitespotted greenling Hexagrammus stelleri

Yellowfin sole Limanda aspera Appendix G2. Studies conducted within the Norton Sound, Port Clarence, and Kotzebue Districts, 1993.

Kwiniuk River Salmon Counting Tower

- a) Location: About five miles upstream from the mouth of the Kwiniuk River in Norton Sound.
- b) Objectives: Determine daily and seasonal timing and magnitude of chum and pink salmon runs. Determine age, sex and size of chinook and chum salmon of the commercial harvest in Moses Point subdistrict.
- c) Results: The 1993 total expanded tower count: 595 chinook, 43,065 pink, and 15,823 chum.

# Unalakleet Salmon Escapement Studies

- a) Location: Unalakleet River
- b) Objective: To maintain an index of salmon migration up the Unalakleet River using test gill nets.
- c) Results:
- 1) The mean day of catch for chinook, chum, pink, and coho salmon was 6/25, 7/29, 7/14, and 8/24, respectively. The peak daily catch of chinook, chum, pink, and coho salmon occurred on 6/24, 8/24, 7/12, and 8/18, respectively.
- 2) The predominant age class in the test fish catch by the European aging method, by species was: chinook salmon 1.2 (age 4), chum salmon 0.4 (age 5) and coho salmon 2.1 (age 4).
- 3) The predominant age class in the commercial catch by the European aging method, by species was: chinook salmon 1.4 (age 6), chum salmon 0.4 (age 5) and coho salmon 2.1 (age 4).

#### Nome River Salmon Counting Tower

- a) Location: Nome River, Approximately 4 miles east of Nome.
- b) Objectives:
  1) To determine daily and seasonal timing and magnitude of the spawning salmon runs.
  - 2) Compare aerial survey totals with tower counts in order to improve survey accuracy.
  - 3) A secondary objective as time and personnel allows would be to collect age and sex data through escapement sampling

of subsistence catches, beach seining or possibly carcass sampling.

c) Results:

The 1993 total expanded tower count: 63 chinook, 1,859 chum, 1,3034 pink, 4,349 coho, and 1,353 Dolly Varden.

## Kobuk River Test Fish Project

- a) Location: Lower Kobuk River
- b) Objectives:
- 1) To evaluate the feasibility of indexing chum salmon escapement in the Kobuk River using systematic drift gill net catches.
- 2) Describe the migratory timing of chum salmon in the Kobuk River.
- 2) Sample for age, sex, and size data.
- c) Results:
- 1) Fishing began on July 12 and continued through August 13.
- 2) A total of 551 chum salmon were caught in a total of 82 drift time periods.
- 3) Scale sample analysis from 462 chum salmon caught in test drift nets indicated an age composition of 1.7% 0.2 (age 3), 28.8% 0.3 (age 4), 66.0% 0.4 (age 5), 3.5% age.

#### Subsistence Fishing Surveys

- a) Location: Norton Sound and Kotzebue Districts.
- b) Objectives: Determine subsistence utilization of salmon for formulating management procedures and goals. House-to-house surveys were conducted in the Kotzebue District villages of Noatak, Shungnak and Noorvik. Subsistence salmon permit returns in the Nome subdistrict was the only data collected in the Norton Sound District. The remaining fishing villages of the Norton Sound and Kotzebue Districts, and the Port Clarence District, were not surveyed due to budget limitations.
- c) Results:
- 1) A total of 70 households were surveyed in the Kotzebue District villages of Shungnak, Noorvik, and Noatak. The total reported chum salmon harvest was 15,430 fish.
- 2) A total of 141 permits were issued for the Nome subdistrict of Norton Sound in 1993 and 115 permits were

returned. Their reported catches totaled 52 chinook, 80 sockeye, 873 pink, 1,766 chum, and 2,070 coho salmon.

Commercial Catch Sampling

a) Locations: Norton Sound, Port Clarence and Kotzebue Sound.

b) Objective: Obtain age, sex, and size information for commercially

caught herring, salmon and king crab.

c) Results: Approximately 2,630 herring, 703 salmon, and 17,833 king

crab were sampled in 1993. These data are being analyzed

and will be presented in separate reports.

Herring Test Fishing

a) Location: Norton Sound ocean waters; camps located at Cape Denbigh

and Klikitarik; a third test fish crew operated out of

Unalakleet.

b) Objectives: To determine age class composition of the Norton Sound

herring return through test fishing with variable mesh gill

nets.

c) Results: Gill nets were operated from May 13 through June 12. Scale

analysis of test fish catches has been completed; results

are listed in Figure 13.

Nearshore Winter King Crab Study

a) Location: Ocean waters of Norton Sound 1 to 2.5 miles south of Nome.

b) Objective: To observe the abundance and distribution of red king crab

in nearshore Nome waters. Also to evaluate the

effectiveness of the "15 mile summer commercial crab closure" in protecting inshore crab; to obtain basic life

history data.

c) Results: A total of 181 male and 1 female red king crab were captured

at the three stations and one subsistence station between

March 3 and April 16, 1993.

**Effective Date** 

June 16, 1993

6:00 p.m. ADT

Action Taken

Emergency Order Number

3-z-s-2-93

155

3-z-s-1-93	June 14, 1993 6:00 p.m. ADT	This emergency order opens the Shaktoolik and Unalakleet Subdistricts to commercial salmon fishing for 24 hours beginning at 6:00 p.m. Monday, June 14 and ending at 6:00 p.m. Tuesday, June 15.	Subsistence catch data and the Unalakleet test fishing data both indicate the king salmon migration is now moving into the rivers. King salmon have been present in nearshore waters for at least ten days. King salmon catches have been gradually increasing in the Unalakleet River test net for the past six days. This indicates a good start on escapement. This opening conforms with the management plan distributed earlier this year. After a week of escapement has occurred, fishing will be allowed. The scheduling of future openings will depend on how the king harvest compares with harvest indices of the past.
			Commercial fishermen are reminded that unsold salmon caught in commercial gear must be reported on fish tickets.

Comments

This emergency order closes the Nome Subdistrict to subsistence salmon fishing in the Sinuk, Cripple, Penny, Snake, Nome, Flambeau, Eldorado, Bonanza, and Solomon Rivers. In addition, the waters of Safety Sound and Bonanza Channel inside the barrier spit and Safety Bridge, as well as ocean waters from the Cape Nome jetty west to the Sinuk River mouth are closed to salmon fishing from 6:00 p.m. June 16 through July 31.

During the four year period, 1987 to 1990 salmon escapements in the immediate Nome area were well below historic levels and the levels the department staff believes are needed to maintain the salmon runs. This is particularly true of the chum salmon stocks.

During 1991 and 1992, the trend of declining chum salmon escapements was broken. Most streams in the Nome area were judged to have adequate chum escapement levels. A similar management technique to what was used in 1991 is planned for the 1993 season. Subsistence fishing will reopen as pink salmon become abundant and as chum escapement goals are met. Various locations and streams will be judged individually and opened on the basis of their individual chum salmon escapement and pink salmon abundance.

The staff will be flying frequent surveys and boating some of the rivers to track the salmon migration's strength and progress. If a stream appears to have adequate escapement, restrictions will be lifted in that area; otherwise, the restrictions will remain in place until they no longer benefit the species of concern.

Appendix G3. Emergency orders issued during 1993.

Emergency

Order Number	Effective Date	Action Taken	Comments
3-z-s-3-93	June 17, 1993 6:00 a.m. ADT	This emergency order opens Norton Bay Subdistrict to commercial salmon fishing beginning at 6:00 a.m. June 17 and closing at 6:00 a.m. June 18. The emergency order also opens the Shaktoolik and Unalakleet Subdistricts to commercial salmon fishing for 24 hours beginning at 6:00 p.m. June 17 and closing at 6:00 p.m. June 18.	Subsistence catch data and the Unalakleet test fishing data both indicate a continued king salmon migration into the rivers. This indicates escapement continues to be at least adequate. The first commercial opening in Subdistricts 5 and 6 had king salmon harvests in the slightly above average range. Since the early portion of the commercial salmon fishery targets king salmon much less consideration was given the chum salmon run strength indices in Subdistricts 4, 5 and 6. However, in the Moses Point Subdistrict, the expected poor chum salmon return and the small size of the resident king salmon stocks have caused the staff to decide against a commercial salmon opening in that subdistrict.
			Commercial fishermen are reminded that unsold salmon caught in commercial gear must be reported on fish tickets.
3-Z-S-4-93	June 21, 1993 6:00 p.m. ADT	This emergency order opens the Shaktoolik and Unalakleet Subdistricts to commercial salmon fishing for a standard king salmon fishing schedule consisting of two 24 hour periods each week beginning at 6:00 p.m. Monday and closing at 6:00 p.m. Tuesday and opening at 6:00 p.m. Thursday and closing at 6:00 p.m. Friday.	Subsistence catch data and the Unalakleet test fishing data both indicate a continued king salmon migration into the rivers. This indicates escapement continues to be at least adequate. The first two commercial openings in Subdistricts 5 and 6 had king salmon harvests in the slightly above average range. The king harvest in the Norton Bay Subdistrict was small and the fish somewhat water marked, as a consequence the buyer has decided to discontinue buying there for the time being. Should the king salmon run strength increase or when the chum salmon migration rises significantly the fishing schedule will be extended.
			Commercial fishermen are reminded that unsold salmon caught in commercial gear must be reported on fish tickets.
3-z-s-5-93	June 21, 1993 6:00 p.m. ADT	This emergency order allows the use of either drift or set gill nets in the Unalakleet and Shaktoolik Subdistricts.	Several fishermen have reported losing nets to driftwood. The situation is serious enough that fishermen are opting not to fish due to the likelihood of ruining their nets and the expense of having to replace those nets.

Harvests were down last period. Escapement still continues as evidenced by the harvests of subsistence river fishermen and the Unalakleet test fishermen. Even with this more efficient gear type harvest rates are not expected to increase dramatically since it requires the close attendence of the fishermen and hardly any nets will fish the entire period as they often do during driftwood free years. This action is intended to reduce the loss of gear and the hardship it imposes on commercial fishermen.

Appendix G3. Emergency orders issued during 1993.

Emergency Order Number	Effective Date	Action Taken	Comments
3-z-s-6-93	June 26, 1993 12:00 noon ADT	This emergency order opens Norton Bay Subdistrict to commercial salmon fishing beginning at 12:00 noon June 26 and closing at 12:00 noon June 27.	Subsistence catch data and the Unalakleet test fishing data both indicate that king salmon have been present in the Norton Bay for over two weeks. During the earlier commercial opening the buyer expressed concern over the poor quality of the salmon caught. They were water marked and only a few fishermen had delivered their catch. The decision was made to wait in hopes of increasing quality and quantity of the catch. Generally fish caught in deeper water are less water marked. Additional openings in this subdistrict are dependent on a buyer willing to purchase fish.
			Commercial fishermen are reminded that unsold salmon caught in commercial gear must be reported on fish tickets.
3-z-s-7-93	June 25, 1993 6:00 p.m. ADT	This emergency order extends the openings in the Shaktoolik and Unalakleet Subdistricts to the standard salmon fishing schedule of two 48 hour periods each week beginning at 6:00 p.m. Monday and closing at 6:00 p.m. Wednesday and opening at 6:00 p.m. Thursday and closing at 6:00 p.m. Saturday.	Subsistence catch data and the Unalakleet test fishing data both indicate the king salmon escapement the rivers is now equal to a normal season total. This indicates escapement is at least adequate. Commercial harvest in Subdistricts 5 and 6 is thought to be well above average for this point in the season. By allowing the standard fishing schedule of two 48 hour openings, additional escapement is expected to occur while allowing commercial fishermen to more fully utilize the abundant king salmon resource.
			Commercial fishermen are reminded that unsold salmon caught in commercial gear must be reported on fish tickets.
3-z-s-8-93	June 27, 1993 12:00 noon ADT	This emergency order extends the current opening in the Norton Bay Subdistrict to commercial salmon fishing that began at 12:00 noon June 26 until 12:00 noon June 28.	During the earlier commercial opening the buyer expressed concern over the poor quality of the salmon caught. They were water marked and only a few fishermen had delivered their catch. The current opening was intended to test the Norton Bay catch to reassess the quality of the catch. Early reports indicate that although the fish have some outward discoloration, they are firm and of sufficient quality to keep the buyer's interest. The buyer has requested the period be extended 24 hours. There are no overriding biological concerns, so the period will be extended until noon Monday.
3-z-s-9-93	June 30, 1993 12:00 noon ADT	This emergency order opens Norton Bay Subdistrict to commercial salmon fishing beginning at 12:00 noon, June 30 and closing at 12:00 noon, July 1.	The salmon buyer for the past two openings at Norton Bay has requested another fishing period to coincide with the closed period in Subdistricts 5 and 6. In this way he anticipates being able tender all the open subdistricts. Although the Norton Bay fish are water marked they are being judged as marketable. The king salmon run strength in eastern Norton Sound is above average, with escapement judged to be above average too. Norton Bay has received significantly less fishing time and effort than the two subdistricts to the south. Consequently, adequate escapement is thought to occurring in the Norton Bay Subdistrict as well.

Appendix G3. Emergency orders issued during 1993.

Emergency Order Number	Effective Date	Action Taken
3-z-s-10-93	July 3, 1993 12:00 noon ADT	This emergency order opens Norton Bay Subdistrict to commercial salmon fishing beginning at 12:00 noon, July 3 and closing at 12:00 noon, July 5.
3-z-s-11-93	July 11, 1993 12:01 a.m. ADT	This emergency order opens portions of the Shaktoolik and Unalakleet Subdistricts to pink salmon fishing beginning at 12:01 a.m. Sunday and closing at 12:00 noon Monday. In the Shaktoolik Subdistrict, the waters from the Shaktoolik River to the point where the bluff starts at the Foothills will be open. In the Unalakleet Subdistrict, the waters from Blueberry Point to Coal Mine Creek will be open. Gill net mesh size will be limited to four and one-half inches or smaller.
3-2-5-12-93	July 12, 1993 6:00 p.m. ADT	This emergency order places the Shaktoolik Subdistrict on pink salmon net restrictions effective Monday, July 12. Gill net mesh size will be limited to four and one-half inches or smaller.
3-2-8-13-93	July 13, 1993 12:00 noon ADT	This emergency order opens a portion of the Golovin Bay Subdistrict to pink salmon fishing beginning at 12:00 Noon Tuesday and closing at 12:00 noon Wednesday. Only waters from the point of Golovin Spit to point of the spit due south of Golovin spit

outward to the southern boundary of the

subdistrict will be open. Gill net mesh

size will be limited to four and one-half

inches or smaller.

The salmon buyer for Norton Bay has requested another fishing period to coincide with the closed period in Subdistricts 5 and 6. In this way he anticipates being able to tender all the open subdistricts. Fishermen are still targeting king salmon, although chum salmon are now becoming more prevalent in the catch. The king salmon run strength in eastern Norton Sound is above average, with escapement judged to be above average too. Norton Bay has received significantly less fishing time and effort than the two subdistricts to the south. Consequently, adequate escapement is thought to be occurring in the Norton Bay Subdistrict as well.

Comments

The pink salmon migration has reached nearshore waters early this week. For the first time in many years there is a pink salmon buyer. Although the pink salmon runs are smaller on odd years, pink salmon have shown the ability to rebound from natural declines in stock size. A harvestable surplus is thought to exist. A thirty-six hour opening will be allowed to check the impact of a pink targeted fishery and the quality of that product. Escapement indices, incidental harvest rates, and total pink salmon harvest will be the points of interest. The findings on these points will influence future decisions.

The fish buyer at Shaktoolik has indicated that chum salmon quality is declining. Pink salmon caught in large gear are not as marketable as the fish taken in small gear either. Consequently, commercial gill net mesh will be limited in the Shaktoolik Subdistrict during the pink salmon run. There will be some incidental chum salmon harvest but chum salmon escapements in nearby rivers should be enhanced and the pink salmon resource will be harvested at its peak value.

The pink salmon migration has reached nearshore waters early this week. For the first time in many years there is a pink salmon buyer. Although the pink salmon runs are smaller on odd years, pink salmon have shown the ability to rebound from natural declines in stock size. A harvestable surplus of pink salmon is thought to exist. The chum salmon run is expected to be weak this year with only a limited surplus. Prior to the season the chum salmon surplus was projected to be 10,000 fish. If this test opening indicates a viable fishery can be conducted at Golovin Bay, additional openings will be allowed until either the chum salmon or the pink salmon resources can no longer provide a harvestable surplus.

Appendix G3. Emergency orders issued during 1993.

Emergency

Order Number	Effective Date	Action Taken	Comments
3-z-s-14-93	July 15, 1993 6:00 p.m. ADT	This emergency order places the Unalakleet Subdistrict on chum salmon net restrictions effective Thursday, July 12. Gill net mesh size will be limited to six inches or smaller.	Regulation requires salmon mesh size to be restricted to six inches or smaller by July 15. The Unalakleet Subdistrict is the only subdistrict not already restricted to a smaller mesh size. The fishing period begins at this time.
3-z-s-15-93	July 17, 1993 6:00 p.m. ADT	This emergency order closes the portions of the Moses Point subdistrict in the Kwiniuk River above the Department's fish counting tower at river mile 2.0 and in the Tubutulik River above the mouth of the river to subsistence fishing beginning at 6:00 p.m., Saturday, July 17. The subsistence fishery in the area described will be reopened by emergency order when chum salmon currently migrating through these river systems have reached their spawning grounds and other salmon species are available for harvest in the subsistence fishery.	Inadequate chum salmon spawning escapements in both the Kwiniuk and Tubutulik Rivers have been a chronic concern for the Moses Point Subdistrict for several years. Although the Kwiniuk River counting tower escapement goal was decreased from 25,000 to 19,500 prior to the 1992 season as a result of an analysis of return per spawner relationships, this goal has only been met twice since 1984. Commercial and sport fishing restrictions and closures alone have not been effective in reversing this trend and rebuilding the once productive chum salmon stocks produced in this subdistrict. The salmon fisheries management plan for the 1993 season closed commercial and sport fishing for salmon during June and July in order to allow run rebuilding and subsistence fishing. The plan also specified that subsistence closures would be enacted if chum salmon escapement is projected inseason to fall significantly below the escapement requirements set for the Subdistrict. On July 16, an assessment of projected escapement past the tower on the Kwiniuk River and an aerial survey of the Tubutulik River indicated that escapements for the Moses Point Subdistrict would not be achieved. The projected end of season escapement past the Kwiniuk River tower was 15,000 chum salmon and early aerial survey counts on the Tubutulik River indicated that the chum salmon run was weak, had already entered the rivers and was moving up into river systems where it would be targeted by traditional subsistence fisheries. Closure of portions of the river systems where the majority of chum salmon were vulnerable to subsistence fishing is necessary in order to allow migrating chum salmon to spawn. The closure will be rescinded as soon as the chum salmon have migrated onto spawning grounds and other salmon species are available for harvest in the lower portions of the drainage.
3-z-s-16-93	July 18, 1993 6:00 p.m. ADT	This emergency order places the Shaktoolik and Unalakleet Subdistrict on pink salmon net restrictions effective 6:00 p.m. ADT Sunday, July 18 for 24 hours with the period ending 6:00 p.m. ADT Monday, July 19. Gill net mesh size will be limited to 4.5 inches or smaller. After the period, both subdistricts will return to their	Projected returns of pinks salmon for the 1993 season in the Shaktoolik (Subdistrict 5) and Unalakleet (Subdistrict 6) subdistricts should allow a surplus in addition to escapement and subsistence harvest requirements and available for commercial exploitation. In order to allow for this harvest of pink salmon without targeting other salmon stocks entering these subdistricts, a limitation of gill net mesh size to 4.5 inch stretch or less is necessary and has been demonstrated to be an effective method of minimizing the by-catch of other salmon species.

schedules and gear

regular fishing

limitations.

09

3-z-s-19-93

Appendix G3. Emergency orders issued during 1993.

August 2, 1993

6:00 p.m. ADT

Emergency Order Number	Effective Date	Action Taken	Comments
3-z-s-17-93	July 22, 1993 8:00 a.m. ADT	This emergency order opens a portion of the Golovin Bay Subdistrict to pink salmon fishing beginning at 8:00 a.m. Thursday July 22 and closing at 8:00 a.m. Friday July 23. Only waters from the point of Golovin Spit to point of the spit due south of Golovin spit outward to the southern boundary of the subdistrict will be open. Gill net mesh size will be limited to four and one-half inches or smaller.	The projected return of pink salmon for the 1993 season in Subdistrict 2, the Golovin area, based on an initial commercial test opening and aerial surveys should allow—a surplus of not more than 10,000 pink salmon in addition to escapement and subsistence harvest requirements available for commercial exploitation. In order to allow for this limited harvest of pink salmon without targeting other salmon stocks entering these subdistricts, only 24 hours of fishing time—and a limitation of gill net mesh size to four and one-half inch stretch or less will be allowed. Use of gill net size limitations has been demonstrated to be an effective method of minimizing the by-catch of other salmon species. Based on harvest rates and expected effort levels observed during the earlier 24 hour, test opening in which 4500 pink salmon were harvested, a commercial harvest of less than 5,000 pink salmon is anticipated. Additional pink salmon directed commercial harvest is not anticipated after this period.
3-z-s-18-93	July 26, 1993 6:00 p.m. ADT	This emergency order closes the Shaktoolik and Unalakleet Subdistricts to salmon	Aerial surveys and the Unalakleet test fishing project indicate the chum salmon escapement is well below the escapement goals set for the rivers

and Unalakleet Subdistricts to salmon fishing schedule for the week of July 26 to July 31.

This emergency order allows beach seining of salmon other than chum salmon in waters open for subsistence fishing. seining is not allowed upstream of the regulatory markers on the Sinuk River two miles above the mouth, in the Nome River above a marker at Osborne, and on the Solomon River upstream of a marker near Jerusalem Creek.

chum salmon escapement is well below the escapement goals set for the rivers in the Unalakleet and Shaktoolik Subdistricts. This coming week is the last week of the commercial chum salmon fishery. Historically, strong chum salmon escapements are still possible during this time period. Relatively few silver salmon will be passing through the commercial subdistricts at this time. Opportunity to harvest silvers will not be significantly affected by this action.

Recent salmon surveys of the local Nome rivers indicate chum salmon escapement did not attain the goals set for the local streams. Chum salmon escapements ranged from 60 to 80% of the goals. The chum salmon run has now tapered off and there is little that can be done to help the chum population this summer. Other salmon species seem to be present in normal abundance. Beach seining is a customary and traditional method of harvesting salmon and the Board of Fisheries has directed the staff to allow normal subsistence practices to occur when fishery stocks are not threatened. Since beach seining is the preferred subsistence fishing method it will be allowed in areas where it is not likely to have a long term effect on salmon resources.

Appendix G3. Emergency orders issued during 1993.

	Emergency Order Number	Effective Date	Action Taken	Comments
	3-z-s-20-93	August 1, 1993 6:00 p.m. ADT	This emergency order shifts the openings in the Shaktoolik and Unalakleet Subdistricts to a standard salmon fishing schedule of two 48 hour periods each week beginning at 6:00 p.m. Sunday and closing at 6:00 p.m. Tuesday and opening at 6:00 p.m. Wednesday and closing at 6:00 p.m. Friday.	Salmon buyers have requested the fishery be managed so that they can avoid buying fish on the weekends. No cargo flights are available during Saturday afternoon or Sunday. Since the chum salmon run is in the late stages and the silver salmon run is now building, the normal silver salmon fishing schedule will be shifted forward one day to accommodate the buyers.
	3-z-s-21-93	August 2, 1993 6:00 p.m. ADT	This emergency order opens the Nome Subdistrict to a standard salmon fishing schedule of two 24 hour periods each week beginning at 6:00 p.m. Monday and closing at 6:00 p.m. Tuesday and opening at 6:00 p.m. Thursday and closing at 6:00 p.m. Friday.	Two commercial fishermen have requested they be allowed to commercially harvest silver salmon in the Nome Subdistrict. The silver salmon return is expected to be strong during 1993. The Nome River tower now indicates the silver salmon migration now exceeds the chum run. Although the harvestable surplus must support a subsistence and sport harvest it is thought a limited commercial harvest could be allowed as well. Should either the escapement or subsistence harvests be judged to be inadequate this commercial season will be closed.
161	3-z-s-22-93	August 6, 1993 6:00 p.m. ADT	This emergency order opens the Moses Point Subdistrict to commercial salmon fishing for a 24 hour period beginning Friday at 6:00 p.m., August 6 and closing Saturday at 6:00 p.m., August 7, 1993.	A commercial salmon buyer has requested a commercial salmon fishing period for the Moses Point Subdistrict with the intention of buying coho salmon. The Moses Point Subdistrict chum salmon escapement goals for the Kwiniuk and Tubutulik Rivers were not reached this season eventhough there has been no commercial fishing allowed and subsistence fishing was restricted for the first time ever. The chum salmon run is believed to be nearly over and there would be little to gain from further management actions. The coho salmon run is expected to be of at least average run strength and could safely tolerate a small commercial harvest. Since the Department's salmon counting tower escapement project is through for the season, this short opening will be used to judge late chum salmon abundance and coho salmon run strength prior to peak coho salmon escapement surveys.
	3-z-s-23-93	August 10, 1993 12:00 p.m. ADT	This emergency order opens the Moses Point Subdistrict to commercial salmon fishing for a 48 hour period beginning at 12:00 noon, Tuesday, August 10 and closing at 12:00 noon, Thursday August 12, 1993.	Chum salmon comprised 7% of the total catch in the previous open commercial fishing period for the Moses Point Subdistrict while the coho salmon run has just begun to build and is expected to be of at least average size. The salmon management plan outlines a standard fishing schedule of two 24 hour periods per week, but the only fish buyer operating in the subdistrict has requested a single 48 hour period per week to reduce costs and is uncertain how long they can actually operate. This fishing period allows for additional fishing opportunity since it is believed that the coho salmon stock could tolerate additional harvest at this time, the total amount of fishing time per week follows the management plan, and the chum salmon stock no longer appears to be threatened by additional commercial fishing effort.

Appendix G3. Emergency orders issued during 1993.

Emergency Order Number	Effective Date	Action Taken -	Comments
3-2-8-24-93	August 17, 1993 12:00 p.m. ADT	This emergency order opens the Moses Point Subdistrict to commercial salmon fishing for a 24 hour period beginning at 12:00 noon, Tuesday , August 17 and closing at 12:00 noon, Wednesday August 18, 1993.	The Norton Sound Salmon Management Plan outlines a standard fishing schedule of two 24 hour periods per week in the Moses Point Subdistrict for stocks of salmon in good health. The coho stock appears healthy and due to poor market conditions, period length and duration has varied. Actual fishing time so far this season has been less than outlined in the management plan. This fishing period has been scheduled at the request of a fish buyer and will provide additional fishing time to obtain a portion of the harvestable surplus of coho salmon.
3-2-8-25-93	August 26, 1993 12:00 p.m. ADT	This emergency order opens the Moses Point Subdistrict to commercial salmon fishing for a 24 hour period beginning at 12:00 noon, Thursday August 26 and closing at 12:00 noon, Friday August 27, 1993.	The Norton Sound Salmon Management Plan outlines a standard fishing schedule of two 24 hour periods per week in the Moses Point Subdistrict for stocks of salmon in good health. The coho stock appears healthy and due to poor market conditions, period length and duration has varied. Actual fishing time so far this season has been less than outlined in the management plan. This fishing period has been scheduled at the request of a fish buyer and will provide additional opportunity to obtain a portion of the harvestable surplus of coho salmon.
3-z-s-26-93	September 5, 1993 6:00 p.m. ADT	This emergency order shifts the opening in the Unalakleet Subdistrict to a standard salmon fishing schedule of an opening at 6:00 p.m. Monday and a closure at 6:00 p.m. Wednesday.	Salmon buyers have requested the fishery be managed so that they can avoid buying fish on the Labor Day weekend. No cargo flights are available during Saturday afternoon until Tuesday afternoon. Since the silver salmon run is in the late stages with a normal run strength and lower than normal fishing effort, the normal silver salmon fishing schedule will be shifted forward one day to accommodate the buyers.
3-X-S-1-93	July 8, 1993 6:00 p.m. ADT	This emergency order places the Kotzebue District on the normal commercial salmon fishing schedule of two 24 hour periods per week beginning at 6:00 p.m. Thursday, July 8 until further notice. The commercial fishing periods will run from 6:00 p.m. Monday until 6:00 p.m. Tuesday and from 6:00 p.m. Thursday until 6:00 p.m. Friday.	In keeping with the management plan published prior to the season, the commercial fishery will open the evening of July 8. The most reliable index of chum salmon run strength is the commercial catch rate. Comparisons of catch rate trends over not less than three periods to the recent 13 year average will be the basis of management decisions made this year. Typically the fishing periods during July are held to 24 hours in length. Unless catch rates deviate significantly from the average, the normal July fishing schedule will continue until August 1.

Appendix G3. Emergency orders issued during 1993.

August 2, 1993

6:00 p.m. ADT

Emergency Order Number	Effective Date	Action Taken	Comments
3-x-s-2-93	July 26, 1993 6:00 p.m. ADT	This emergency order closes and reopens the Kotzebue District for a single fishing period beginning on July 29 at 6:00 p.m. for 24 hours.	Commercial catch rates during periods 3, constant at a time when it would normall catch has actually declined since period have reported a decline in their catches. The four year-old age component of this rof the normal strength. The 5 and 6 yes be roughly normal strength. The net resmay only be one-half the historical averagement, the commercial harvests must be escapements to be obtained. Period six salmon to migrate up the Kobuk River. I proceed to re-evaluate the age composition old component of the run does not rise second to the season will have any most year-old age class ceases to be a significant of the season be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class ceases to be a significant of the season will have any most year-old age class year-old age class year-old age class year-old age class year-old age year

This emergency order closes and reopens the

Kotzebue District for a single fishing period beginning on August 5 at 6:00 p.m.

for 24 hours.

, 4, and 5 have been very low and ly rise rapidly. The commercial od 3. Lower Kobuk River fishers es during the last week as well. run now appears to be roughly 25% rear-old age components appear to esult is the 1993 chum salmon run erage. If the younger fish do not e minimized in order for adequate is being canceled to allow some Period seven will be allowed to ion of the run. If the four yearsignificantly, the period 8 will be used to determine whether the more openings. Historically, the nificant portion of the run after the tenth period and without many younger fish returning not much could be done to enhance escapement beyond that point.

Commercial catch rates during periods 3, 4, 5 and 7 have been very low at a time when the rate would normally rise rapidly. Lower Kobuk River fishers have reported a decline in their catches since the commercial fishery began. The four year-old age component of this run now appears to be roughly 25% of the normal strength. The 5 year-old age component appears to be roughly normal strength. The net result is the 1993 chum salmon run may only be one-half the historical average. If the younger fish do not return, the commercial harvests must be minimized in order for adequate escapements to be obtained. Period eight is being canceled to allow some salmon to migrate up the Kobuk River. Period nine will be allowed to proceed to re-evaluate the age composition of the run. If the four year-old component of the run does not rise significantly, period 9 will be used to determine whether the remainder of the season will have any more openings. Historically, the 5 year-old age class ceases to be a significant portion of the run after the tenth period and without many younger fish returning little could be done to enhance escapement beyond that point.

3-x-s-3-93

Appendix G3. Emergency orders issued during 1993.

Emergency Order Number	Effective Date	Action Taken
3-X-S-4-93	September 9, 1993 12:00 noon ADT	This emergency order opens the lower Noatak River for commercial fishing once a field announcement is made.
3-z-н-1-93	May 24, 1993 11:30 a.m. ADT	This emergency order opens Subdistrict 2 and 3 to beach seining of commercial herring, beginning 11:30 a.m. and running until 2:30 p.m. Monday May 24.
3-z-H-2-93	May 25, 1993 11:00 a.m. ADT	This emergency order opens Subdistrict 2 and 3 to beach seining of commercial herring, beginning 11:00 a.m. and running

until 2:00 p.m. Tuesday May 25.

A surplus of 20,000 to 40,000 chum salmon is expected at the Sikusuilaq Hatchery. Because the commercial fishery was closed during most of the Noatak wild stock migration an unexpectedly large portion of the hatchery stock avoided harvest. The Northwest Arctic Borough has surveyed the users of the Noatak salmon resource and determined that it is in the interest of those people to harvest the surplus salmon. This emergency order facilitates this new fishery. On site management is thought to be prudent given the unknowns of this unique fishery.

Comments

Yesterday's aerial surveys sighted relatively light concentrations of herring from Shorty Cove to Point Dexter. Test fishing found the best roe percentages at Besboro Island with a combination of marketable and unmarketable roe distributed along the coast of the mainland. Age data indicates only the oldest age classes are present in nearshore areas at this time. The younger herring are expected to show soon and the quality of the catch is likely to decline over time as these older fish spawn and unripe younger fish move into the near shore areas. Various buyers have expressed an interest in large herring. The opportunity to target large ripe fish by beach seine is not expected to last much longer, an opening at this time provides an opportunity not often available.

Beach seine fishermen are advised to test their catch prior to drying up and keep in mind the strict quality requirements in effect this year.

Yesterday's aerial surveys sighted 5700st of herring in the Cape Denbigh Subdistrict with relatively light concentrations of herring from Shorty Cove to Shaktoolik. Test fishing found the fish near Point Dexter to be skittish and the Department net caught 28% green fish. We believe that this indicates the arrival of new fish into the near shore areas and that roe percentages are likely to decline in the Cape Denbigh area while fish enter the area. Yesterdays opening had a reported harvest of 179 tons with an average roe percent of 9.1% Various buyers have expressed an interest in large herring. The opportunity to target large ripe fish by beach seine is not expected to last much longer, an opening at this time provides an opportunity not often available.

Beach seine fishermen are advised to test their catch prior to drying up and keep in mind the strict quality requirements in effect this year.

Appendix G3. Emergency orders issued during 1993.

Emergency Order Number	Effective Date	Action Taken	Comments
3-z-н-3-93	May 25, 1993 5:00 p.m. ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistrict 2 and 3 to commercial fishing, beginning 5:00 p.m. and running until 8:00 p.m. Tuesday May 25.	Although the beach seine roe percentages have varied, most sets have been of marketable quality. This mornings test sets in the Cape Denbigh area were of acceptable quality as well. Test gill net sets in subdistrict 1 indicated a high male count and very limited quantities. Aerial surveys found good showings of herring at Cape Denbigh on both sides and along the foothills between Beeson Slough and Coffee Pot Creek. Winds that developed during the late morning caused the herring which had spawned earlier to back off the beach, making them inaccessible to the fishing fleet. This opening is targeting herring schooled on the beach, primarily in Subdistrict 3. These fish are thought to be large ripe fish that have not yet mingled with the "new fish" sighted yesterday. The limitation of one shackle of net per vessel is intended to limit the potential harvest of the opening and to encourage fishermen to more closely monitor the quality of their catch.
3-2-H-4-93	May 26, 1993 11:00 a.m. ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistricts 1, 2 and 3 to commercial fishing, beginning 11:00 a.m. and running until 4:00 p.m. Wednesday May 26.	Yesterday's gill net fishery produced a harvest of 1000 tons of herring averaging 9.3%. This rate of harvest was sufficient to provide roughly one day's processing capacity. Since the roe quality is unlikely to increase and may actually decline should more fish arrive on the grounds, it seems appropriate to maximize harvest at this time. This second opening is intended to harvest approximately two days processing capacity.
3-2-н-5-93	May 26, 1993 4:00 p.m. ADT	This emergency order extends the Norton Sound herring gill net fishing period that began at 11:00 a.m. in Subdistricts 1, 2 and 3 from 4:00 p.m. until 6:00 p.m. Wednesday May 26.	The catch rate of today's gillnet fishery is considerably slower than yesterday's fishery. However the roe quality is holding up well. Several buyers have expressed their wish to continue today's fishery. Judging from the tide graphs, an extension of two hours could be allowed without a great risk of intercepting spawned-out fish moving on the ebb tide.
3-Z-H-6-93	May 27, 1993 11:30 a.m. ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistricts 1, 2 and 3 to commercial fishing, beginning 11:30 a.m. and running until 4:30 p.m. Wednesday May 27.	Yesterday's gill net fishery produced a harvest of 1094.8 tons of herring averaging 9.7%. This rate of harvest was sufficient to provide roughly one day's processing capacity. Since the roe quality is unlikely to increase and may actually decline should more fish arrive on the grounds, it seems appropriate to maximize harvest at this time. This opening is intended to harvest approximately two days processing capacity.

Appendix G3. Emergency orders issued during 1993.

Emergency Order Number	Effective Date	Action Taken
3-z-H-7-93	May 28, 1993 12:00 noon ADT	This emergency order opens Subdistrict 1, 2 and 3 to the commercial beach seining of herring, beginning 12:00 noon and running until 3:00 p.m. Friday May 28.
3-z-H-8-93	May 30, 1993 12:00 noon ADT	This emergency order opens Subdistrict 1 to the educational permit herring fishery, beginning 12:00 noon Sunday May 30 until 10 tons have been harvested.
3-z-H-9-93	May 31, 1993 1:00 p.m. ADT	This emergency order opens Subdistrict 2, including Besboro Island, to the commercial beach seining of herring, beginning 1:00 p.m. and running until 3:00 p.m. Monday, May 31.
3-2-н-10-93	June 1, 1993 6:30 p.m. ADT	This emergency order opens Subdistrict 2 of the Norton Sound Commercial Herring Fishing District to the commercial beach seining of herring, beginning 6:30 p.m. Tuesday, June 1 and running until 4:00 a.m. Wednesday,

June 2. Since the opening will be under the direct supervision of a management

biologist, the opening may be closed

earlier if the limit is reached or if

quality is determined to be unsatisfactory.

Yesterday's gill net opening produced much slower catches than expected. with both unripe and spawned out herring bringing the roe quality down. However, several small pockets of good quality herring were reported at several locations. Since a portion of the beach seine herring allocation is available and the ability to release poor quality fish exists, a fishing period can be allowed with little risk of wasting the resource. Beach seine fishermen are advised to test their catch prior to drying up and keep in mind the strict quality requirements in effect this year.

Comments

A ten ton harvest has been allowed annually since 1989 for the educational permit held by the Bering Strait School District. This fishery can be used to monitor the quality of the herring available to a possible gill net fishery in the St. Michael area for the next several days while providing a opportunity for the vocational class. This small harvest will not affect the potential of any future gill net opening.

Yesterday's sampling efforts indicated a small quantity of ripe herring at Besboro Island and at St. Michael's Bay. By the time the sampling had occurred there was not sufficient time to open before the tide dropped precipitously. This morning's sample indicates a similar quality and quantity to what was present yesterday. Since a portion of the beach seine herring allocation is available and the ability to release poor quality fish exists, a fishing period can be allowed with little risk of wasting the resource. Beach seine fishermen are advised to test their catch prior to drying up and keep in mind the strict quality requirements in effect this year.

The Norton Sound Herring Management Plan states that the beach seine harvest will not exceed 905st. The beach seine harvest to date is 750st. Due to this year's long drawn out season, all beach seine fishermen signed a cooperative agreement where they would consolidate their efforts to harvest the remaining portion of the beach seine quota. The catch would be evenly split between the permits. If roe quality is unacceptable to prospective buyers the herring will be released before drying-up. Once a set has been accepted, the fish will be pumped by a tender and any excess fish above the set quota will being released. Therefore, the allowable catch could be fully utilized with little threat of overharvest.

Appendix G3. Emergency orders issued during 1993.

Emergency

Order Number	Effective Date	Action Taken
3-2-н-11-93	June 2, 1993 5:00 p.m. ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistrict 1 to commercial fishing, beginning 5:00 p.m. and running until 8:00 p.m. Wednesday, June 2. Each boat will be limited to not more than 50 fathoms of gill net.
3-2-H-12-93	June 2, 1993 8:00 p.m. ADT	This emergency order extends the Norton Sound commercial herring gill net fishery in Subdistrict 1 until 11:00 p.m. Wednesday June 2. Each boat will be limited to not more than 50 fathoms of gill net.
3-z-H-13-93	June 3, 1993 2:30 p.m. ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistrict 1 to commercial fishing, beginning 2:30 p.m. and running until 5:30 p.m. Thursday, June 3. Each boat will be limited to not more than 50 fathoms of gill net.
3-Z-H-14-93	June 3, 1993 5:30 p.m. ADT	This emergency order extends the Norton Sound commercial herring gill net fishery in Subdistrict 1 until 10:00 p.m. Thursday, June 3. Each boat will be limited to not more than 50 fathoms of gill net.
3-z-H-15-93	June 3, 1993 1:00 p.m. ADT	This emergency order opens Subdistrict 5 of the Norton Sound Commercial Herring Fishing District to the commercial beach seining of herring, beginning 1:00 p.m. Thursday, June 3 until 4:00 p.m. Friday, June 4. Since the opening will be under the direct supervision of the management biologist, the opening may be closed earlier if the limit is reached or if quality is determined to be unsatisfactory.

Today's aerial survey sighted 41,000 tons. Roughly 1600 tons were in the western portion of the Subdistrict where several miles of spawn were under way. Herring were approaching the beach ahead of the spawn. Later in the morning test sets were made on these fish. Roe percentages well above 9% were reported and pilot reports in the early afternoon indicated more fish were moving into spawn. On that basis, a three hour opening was announced with the possibility of an extension if roe percents and volume were adequate.

Comments

Early reports from the gill net opening indicate good quality and increased quantities of fish. Given the greatly reduced number of fishermen present during this opening there is little risk of exceeding the processing capacity. Therefore the fishing period is extended to take advantage of the harvestable surplus that is currently present on the grounds.

The estimated biomass for this season now stands at roughly 45,000 tons. The exploitation rate is estimated to be 11%, well below the 20% allowed by regulation. This morning's aerial survey sighted herring on the east and south sides of Stuart Island. Given the good roe percentages present yesterday, an opening will be allowed with the hope of a similar quality harvest today. An extension is possible if quality and quantity can be maintained.

Early reports from the gill net opening indicate good quality and continued good quantities of fish. Given the low harvest to date, there is no need to slow the harvest rate. Therefore the fishing period is extended to take advantage of the harvestable surplus that is currently present.

The Norton Sound Herring Management Plan states that the beach seine harvest will not exceed 905st. The beach seine harvest to date is 776st. Due to this year's long drawn out season, all beach seine fishermen signed a cooperative agreement where they would consolidate their efforts to harvest the remaining portion of the beach seine quota. The catch would be evenly split between the permits. If roe quality is unacceptable to prospective buyers the herring will be released before dried up. Once a set has been accepted, the fish will be pumped by a tender and any excess fish above the set quota will being released. Therefore, the allowable catch could be fully utilized with little threat of overharvest. Because beach seine quality fish are becoming harder to find and the department cannot afford to designate personnel solely to supervise another beach seine attempt, this will be the final opening to fill the beach seine quota.

Order Number	Effective Date	Action Taken
3-z-H-16-93	June 4, 1993 9:00 a.m. ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistrict 1 to commercial fishing, beginning 9:00 a.m. and running until 12:00 noon Friday, June 4. Each boat will be limited to not more than 50 fathoms of gill net.
3-2-н-17-93	June 4, 1993 12:00 noon ADT	This emergency order extends the Norton Sound commercial herring gill net fishery in Subdistrict 1 until 3:00 p.m. Friday June 4. Each boat will be limited to not more than 50 fathoms of gill net.
3-z-H-18-93	June 5, 1993 12:00 noon ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistrict 5 to commercial fishing, beginning 12:00 noon and running until 3:00 p.m. Saturday, June 5. Each boat will be limited to not more than 50 fathoms of gill net.
3-2-н-19-93	June 5, 1993 3:00 p.m. ADT	This emergency order extends the Norton Sound commercial herring gill net fishery in Subdistrict 5 until 7:00 p.m. Saturday, June 5. Each boat will be limited to not more than 50 fathoms of gill net.
3-z-H-20-93	June 10, 1993 6:00 p.m. ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistrict 7 to commercial fishing, beginning 6:00 p.m. Thursday, June 10 and running until 6:00 p.m. Saturday, June 12. Each boat will be limited to not more than 50 fathoms of gill net.

Comments

The estimated biomass for this season now stands at roughly 45,000 tons. The exploitation rate is estimated to be 11%, well below the 20% allowed by regulation. This morning's aerial survey sighted herring on the north and south sides of Stuart Island. Given the good roe percentages present yesterday, an opening will be allowed with the hope of a harvest of similar quality today. An extension is possible if quality and quantity can be maintained.

Early reports from the gill net opening indicate decreased quantities of fish, but still good quality. Given the low harvest to date, the fishery will be allowed to utilize the good quality herring still available in nearshore waters and the fishing period is extended.

Aerial survey estimates for this subdistrict have been about 1,000 tons for the past 3 days. Spawn occurred yesterday on the high tide at Portage Roadhouse. Roe samples from test sets last night were mixed, with some sets having roe percentages greater than 9%. Further testing this morning resulted in several companies expressing an interest in buying herring from the subdistrict. Therefore, a three hour opening will be allowed with the possibility of an extension if quality and quantity can be maintained.

Early reports from the gill net opening indicate moderate quantities of fish and good quality. Given the low harvest to date, the fishery will be allowed to harvest good quality herring still available in nearshore waters and the fishing period is extended.

Several Nome residents have expressed an interest in procuring herring for their own use, either as food or bait for the upcoming crab fishery. Since the sac roe fishery harvest has fallen far short of taking the harvestable surplus, a small food/bait harvest will not stress the herring population. An aerial survey flown June 7 indicated the presence of 370 st of herring in this subdistrict. Catches are expected to be small. This opening is intended to make herring available to area residents and assist commercial crab fishermen in preparing for their season.

Appendix G3. Emergency orders issued during 1993.

Emergency Order Number	Effective Date	Action Taken	Comments
3-z-H-21-93	June 16, 1993 6:00 p.m. ADT	This emergency order opens the Norton Sound herring gill net fishery in Subdistrict 7 to commercial fishing, beginning 6:00 p.m. Wednesday, June 16 and running until 6:00 p.m. Friday, June 18.	Several Nome residents have expressed an interest in procuring herring for their own use, either as food or bait for the upcoming crab fishery. Since the sac roe fishery harvest has fallen far short of taking the harvestable surplus, a small food/bait harvest will not stress the herring population. No commercial harvest was reported from the opening on June 10 although several subsistence fishermen were able to make successful sets. An aerial survey flown on June 15 found over 600st from Nome west to Cape Douglas. Since a harvestable surplus and an unmet need still exists, consequently another opening will be allowed. Catches are expected to be small. This opening is intended to make herring available to area residents and assist commercial crab fishermen in preparing for their season.
3-z-K-1-93	July 15, 1993 12:01 a.m. ADT	This emergency order relaxes the closed line to 64 degrees 20 minutes north latitude effective 12:01 a.m. July 15.	Catch rates in the Norton Sound king crab fishery are very slow, averaging about five legals per pot lift. Active fishing has occurred for seven days and some prospecting has occurred in open waters. catch rates have not increased. The poor catch rate is thought to be caused by the early timing of the fishery and the seasonal migration of the crab. By allowing fishing nearer shore should result in an increased catch rate. Past fisheries had catch rates of 20 to 30 legals per pot lift.
			The risk of handling sublegal crab and the associated mortality was considered prior to this decision. There are less than 300 pots fishing at this time. Relative to past years, the harvest rate as a whole is quite small and so would be the catch rate on under sized crab. Fishermen have the ability to rapidly move off small crab if they find themselves in a poor location, since there are large areas with no fishing effort this year.
3-2-K-2-93	August 28, 1993 Noon ADT	This emergency order closes the summer commercial king crab fishery in the Norton Sound Section effective noon August 3.	A NMFS trawl study estimated 3,400,000 pounds of legal male red king crab to be in open waters during late August 1991. The Norton Sound red king crab stock has been exploited at 10% in recent years while maintaining a modest upward trend in population size. The reported verbal catch is 320,000 pounds of crab. By allowing the commercial fishery to continue two days the harvest is expected to reach the ten percent harvest goal of 340,000 pounds. The two day notice is intended to allow the crabbers adequate time to remove their pots from the water prior to the closure.

Appendix G4. Norton Sound-Port Clarence-Kotzebue Sound processors and associated data, 1993.

Company	Representative Address	Type of Processing	District
Arctic Fish Co.	Kotzebue	Fresh Salmon	Kotzebue
Deep Sea Fisheries	5305 Shilshole Ave NW Seattle, WA 98117	King Crab	Norton Sound
Glacier Fish Company	1200 West Lake Ave North Suite 900 Seattle, WA 98109	Frozen Herring Fresh Salmon	Norton Sound Norton Sound
Icicle Seafoods	4019-21st Ave West Seattle, WA 98199	Frozen Herring	Norton Sound
Inlet Fisheries	P.O. Box 530 Kenai, 99611	Fresh Salmon	Kotzebue
Interior Alaska Fish Processors	878 Lynwood Way North Pole, AK 99705	Fresh Salmon	Norton Sound
Kotzebue Commercial Fisherman Inc.	P.O. Box 193 Kotzebue, AK 99752	Fresh Salmon	Kotzebue
New West	601 West Chestnut Bellingham, WA 98226	Frozen Herring	Norton Sound
Norquest	4225 23rd Ave West Seattle, WA 98199	Frozen Herring	Norton Sound
North Alaska Fisheries		Fresh Salmon	Kotzebue
Pan Pacific Seafood	150 Nickerson St. Suite 103 Seattle, WA 98109	Frozen Herring	Norton Sound
Trident	5303 Shilshole Ave NW Seattle, WA 98107	Frozen Herring	Norton Sound
Whitney Foods	4401 W Intl Aiport Rd Anchorage, AK 99502	Fresh Salmon	Norton Sound

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